Occupational Outlook Handbook

1959 EDITION

Career Information
for Use in Guidance

UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
in cooperation with
VETERANS ADMINISTRATION

Bulletin No. 1255

Pointers on Using the Handbook

To find out what is in this book and how it is arranged, see Guide to the Handbook, page 3.

To locate an occupation or industry in this book, look in:

Table of Contents, page xi.

Alphabetical Index, page 770.

List of Occupations Classified by Broad Fields of Work, page 761. This can be used to find occupations suitable for a person with certain types of abilities or interests.

For a general view of work and jobs in the United States, read the chapters on Economic and Occupational Trends, page 10, and Earnings from Work, page 23.

Forecasts of the future are precarious! In interpreting the statements on the outlook in each occupation, keep in mind the points made on page 4.

The job picture is constantly changing. To find out how you can keep your information up to date, see the Section on Where To Go for More Information or Assistance, page 6.

You may need local information too. This book gives facts about each occupation for the United States as a whole. For suggestions on where to get information for your own locality, see page 6.

OCCUPATIONAL OUTLOOK HANDBOOK

EMPLOYMENT INFORMATION ON MAJOR OCCUPATIONS FOR USE IN GUIDANCE

1959 edition

Bulletin No. 1255

(Revision of Bulletin 1215)

UNITED STATES DEPARTMENT OF LABOR

James P. Mitchell, *Secretary*

BUREAU OF LABOR STATISTICS

Ewan Clague, *Commissioner*

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This volume was prepared by the U.S. Department of Labor's Bureau of Labor Statistics with the cooperation of the following Bureaus of the Department—

Bureau of Employment Security
Robert C. Goodwin, Director

Women's Bureau
Alice K. Leopold, Director

Bureau of Apprenticeship and Training
W. C. Christensen, Director

Bureau of Labor Standards
Arthur W. Motley, Director

and the—

Veterans Administration

U.S. Department of Agriculture

U.S. Department of Health, Education, and Welfare

Foreword

The Department of Labor is proud to present this fourth edition of the Occupational Outlook Handbook. For counselors responsible for providing vocational guidance to others and young people considering their own career choices, it has been our aim to include within the pages of this book the best possible information regarding this Nation's present manpower needs and the employment outlook in the years ahead.

Our growing economy creates an expanding need for skilled manpower that can be met only by enabling each individual to use his capabilities to the utmost. The U.S. Department of Labor is actively engaged, in several ways, in aiding the development of a skilled and versatile work force. We promote the development of skills through apprenticeship and other training programs within industry. We aid the State employment services in their programs of providing placement and counseling services. Finally, we carry on research and make information available on manpower needs and employment opportunities in the various industries and occupations, so that individuals can make their career choices, and educational authorities and industry can develop their training plans, on the basis of up-to-date, authoritative information.

The Occupational Outlook Handbook is a major part of this research and educational program. It is our hope that the present edition, like the earlier ones, will assist many young people in making a wise career choice and will thus contribute both to their own life adjustment and to the best use of the Nation's manpower resources.

James P. Mitchell, *Secretary of Labor*

Prefatory Note

This fourth edition of the Occupational Outlook Handbook supersedes the third edition, Bulletin 1215, published in 1957.

Designed to provide the occupational information young people need to help them in career decisions, this book is the product of many years of research by the Occupational Outlook Service, which was established in the U.S. Department of Labor's Bureau of Labor Statistics by the Congress in 1940. The first edition of the Handbook was published in 1949. The wide use of this edition and the subsequent ones, issued in 1951 and 1957, attest to the need for occupational outlook information. More than 120,000 copies of these editions have been sold. Counselors in many high schools, colleges, and community agencies throughout the Nation rely on the Handbook in their vocational guidance work, as do Federal and State agencies offering counseling services—including the Veterans Administration, the U.S. Department of Defense, State rehabilitation agencies, and offices of State employment services affiliated with the U.S. Employment Service.

Because of the rapid changes which characterize the American economy and the consequent importance of up-to-date occupational information for use in guidance, the Congress in 1955 provided for the maintenance of the Occupational Outlook Handbook and related publications on an up-to-date basis. This action has made possible the present edition of the Handbook, plans for subsequent periodic revisions, and the publication of a periodical, the Occupational Outlook Quarterly, which is being issued to provide a continuous flow of current information between editions of the Handbook.

This fourth edition of the Handbook presents a reappraisal of the employment outlook in the occupations and industries discussed in previous editions, together with the most recent information on earnings, training requirements and other topics which was available early in 1959 when the book went to press. In addition, chapters have been added on a number of large and important occupational groups not covered in the third edition—including sales personnel, technicians, clergymen, school counselors, protective service workers, programmers, office-machine operators, motor vehicle drivers, instrument repairmen, stationary engineers, and workers in the missile, paper and pulp, and baking industries.

The Bureau of Labor Statistics wishes to acknowledge with gratitude the cooperation of hundreds of business organizations, unions, trade associations, educational institutions, professional societies, and government agencies whose officials gave freely of their time in discussing employment trends in their respective fields, in supplying information, and in reviewing and commenting upon drafts of the various chapters. Special contributions were made by the Women's Bureau and the Bureau of Employment Security of the U.S. Department of Labor, the Agricultural Research Service of the U.S. Department of Agriculture, and the Office of Education of the U.S. Department of Health, Education, and Welfare. The Veterans Administration has also made a major contribution to the Handbook, since much of the basic research underlying this edition was carried on over the past 14 years with the counsel and financial support of that agency.

EWAN CLAGUE, *Commissioner of Labor Statistics*

Letter From the Veterans Administration

The Occupational Outlook Handbook has long been a key resource in the counseling and training of veterans. Since the inception of the War Orphans' Educational Assistance program in 1956, it has been of equal value in the counseling and career planning of war orphans. Its increasing use by school and college counselors throughout the Nation is gratifying, and a further evidence of the basic counseling need met by this publication.

The Veterans Administration is proud of its long association with the Bureau of Labor Statistics of the U.S. Department of Labor in the progressive development of the Handbook. The foresight of the Congress in authorizing the Administrator of Veterans Affairs to make current and reliable information on occupations available to veterans participating in the Vocational Rehabilitation and Education programs has been realized in a systematic and comprehensive series of cooperative occupational outlook publications extending back to 1945. The first edition of the Occupational Outlook Handbook, published in 1949, was a revision of a 1946 publication known as VA Manual M7-1, Occupational Outlook Information. Subsequent editions of the Handbook were published in 1949, 1951, and 1957. This new edition reflects a projected plan for revised editions at frequent intervals. The Veterans Administration is also continuing its cooperative support of the supplemental Occupational Outlook Quarterly and of periodic interim reports on the employment outlook in specially selected fields of work.

Advances in the understanding and guidance of the vocational development of individuals depend in highly significant part on the systematic study and realistic portrayal of our increasingly complex and changing world of work. This Handbook is a major contribution to the achievement of that goal.

Sumner G. Whittier, *Administrator*
Veterans Administration

Letter From the Bureau of Employment Security

The Bureau of Employment Security considers up-to-date occupational information indispensable in carrying out its counseling and placement responsibilities. We are pleased, therefore, that the fourth edition of the Occupational Outlook Handbook as well as succeeding editions will be available on a regularly scheduled basis to employment counselors in the State employment services. The Handbook has proven to be a most helpful reference document on important occupational and industrial fields in our economy.

About 10 million job seekers come to local employment service offices each year. About 900,000 of them receive employment counseling in these offices. Employment service counselors use the Occupational Outlook Handbook as an important source of national information to supplement the local, State, and national information they get through regular employment service channels. Employment service counselors also encourage counselees to read the Handbook for information that will help them in determining the extent of their interest in specific occupational fields and their possible qualifications for entering these fields. A copy of the Handbook is available for reference in each of the 1,800 local employment service offices.

Occupational choice is so wide, and yet so critical to our manpower outlook, that the prospective worker must have the most reliable and up-to-date factual information on which to base his vocational decision. Increasingly, people seek professional help from a counselor in analyzing their own interests and abilities, and in matching these characteristics to job demands and employment possibilities. Such counseling help, along with job placement, testing, and other related services, is available in local employment service offices throughout the Nation. A brief description of what the public employment offices offer the jobseeker appears on page 7.

On behalf of the Bureau of Employment Security and the affiliated State employment security agencies, I extend to all readers of the Handbook who are making occupational choices an invitation to go to the nearest local office of the State employment service if they wish additional information and assistance in formulating their vocational plans.

ROBERT C. GOODWIN, *Director*
Bureau of Employment Security

Letter From American Personnel and Guidance Association

With the spotlight shining so brightly on the importance of guidance to youth, the unemployed, and adults changing their careers, the counselor today needs every means at his disposal that will help him give these individuals sound occupational information. One of the most authoritative, current, and realistic sources of information about occupations, employment trends, and the Nation's fluctuating career patterns is the Occupational Outlook Handbook. It is constantly at the fingertips of the conscientious counselor who realizes that his knowledge of the world of work must be accurate and up to date.

It is not always easy for the busy counselor to keep abreast of the complex and rapidly changing career picture; yet he knows that he must if he is to help individuals reach vocational decisions. This Handbook lightens his load considerably, for it draws on the countless available resources and presents this wealth of information in a compact and usable form. The Occupational Outlook Handbook also works for the counselor by predicting employment trends.

For these reasons, this fourth edition will be eagerly received by the counselor who has faith in the continuous and systematic research program carried on by the Bureau of Labor Statistics. This countinuous process means that he can look forward not only to frequent future editions, but also to current outlook information through the periodical, Occupational Outlook Quarterly, wall charts, bulletins, and special reports. It is with great pleasure that I express my gratitude and that of countless of my fellow workers in guidance for this new and improved Handbook.

WALTER F. JOHNSON, JR., *President*
American Personnel and Guidance Association

Contributors

This Handbook was prepared in the Bureau of Labor Statistics, Division of Manpower and Employment Statistics under the direction of Seymour L. Wolfbein, Division Chief, and Harold Goldstein, Assistant Division Chief for Analysis.

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The section on putting the Handbook to work was prepared by Frank L. Sievers, Chief, Guidance, Counseling, and Testing Section, Office of Education, U.S. Department of Health, Education, and Welfare.

The photographs credited to the U.S. Department of Labor were taken by James B. Lindley of the Visual Services Section. Some photographs were supplied by various other Government agencies as shown by the credit lines accompanying the pictures. The following organizations either contributed the remaining photographs or made their facilities available for the Labor Department photographer: Acacia Mutual Life Insurance Co.; American Bakers Association; American Bankers Association; American Dental Association; American Dietetic Association; American Institute of Architects; American Occupational Therapy Association; American Optometric Association; American Paper and Pulp Association; American Physical Therapy Association; American Red Cross; American Telephone and Telegraph Co.; Ames Aeronautical Laboratory; Bakelite Co.; Bausch & Lomb Optical Co.; Baylor University College of Dentistry; Bluebird Cab Co.; Brookhaven National Laboratory; Brown and Sharpe Manufacturing Co.; Burroughs Corp.; CBS-Hytron; Capitol Radio Engineering Institute; Central Armature Works, Inc.; Chicago, Burlington & Quincy Railroad Co.; Chicago Police Department; Chrysler Corp.; Columbia Broadcasting Co.; D.C. Fire Department; Davidson Transfer and Storage Co.; Detroit Edison Co.; Dupont Chemical Co.; Eastern Greyhound Lines; Educational Council for the Graphic Arts Industry, Inc.; Erie Railroad; Farrel-Birmingham Co., Inc.; Fleet Owner Magazine; General Electric Co.; General Motors Corp.; Gilpin Wholesale Druggists; The Hecht Co.; Higger's Drugs, Inc.; Hot Shoppes, Inc.; Illinois Central Railroad; Institute of Life Insurance; International Association of Bridge, Structural and Ornamental Iron Workers; International Association of Electrotypers and Stereotypers; International Association of Heat and Frost Insulators and Asbestos Workers; International Association of Machinists; International Business Machines Corp.; Marchant Calculating Machine Co.; Milady Publishing Corp.; Milk Industry Foundation; Minneapolis-Honeywell Regulator Co.; National Association of Home Builders; National Broadcasting Co.; National Canners Association; National Cash Register Co.; National Committee for Careers in Medical Technology, Inc.; National Education Association; National League for Nursing; New York Employing Printers Association; North American Aviation, Inc.; Railway Age; Ransdell, Inc.; Reinhold Publishing Corp.; Sheffield Corp.; Sperry Rand Corp.; Standard Brands, Inc.; Standard Oil Co. of New Jersey; Statler-Hilton Hotel; Ted Bernstein Associates; U.S. Steel Corp.; Union Trust Co.; United Air Lines; United Horological Association of America, Inc.; WTOP-TV; Washington Post and Times Herald; Westinghouse Electric Co.; and Willamette Iron and Steel Co.

Note

A great many trade associations, professional societies, unions, and other organizations in industry are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of users of this Handbook, the reports on occupations or industries list organizations or publications which may be able to provide further information. While these references were assembled with care, the Bureau of Labor Statistics has no authority or facilities for investigating organizations. Also, since the Bureau has no way of knowing in advance what information or publications each organization may send in answer to a request, the Bureau cannot evaluate the accuracy of such information. *The listing of an organization, therefore, does not in any way constitute an endorsement or recommendation by the Bureau or the Department of Labor, either of the organization and its activities or of the information it may supply.* Such information as each organization may issue is, of course, sent out on its own responsibility.

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OCCUPATIONAL OUTLOOK HANDBOOK

Putting the Handbook to Work

The increased guidance activities and responsibilities which will result from the implementation of the National Defense Education Act of 1958 place a greater importance than ever upon having available current occupational data. This 1959 edition of the Occupational Outlook Handbook is therefore most timely. Counselors, teachers, guidance supervisors, and counselor trainers will welcome it as an essential tool in carrying out one very important area of their work.

Another point about the revision in which counselors will be interested is that the Handbook now includes, for the first time, an occupational report on the counselor in public schools. Both of these factors are indicative of the increasing nationwide emphasis on guidance, and point up the necessity for continuous refinement of the basic materials utilized in performing guidance functions.

As the name implies, the Handbook deals with and interprets trends in occupations. Basically, it is not a text in occupations, nor does it attempt to delineate methods for use in disseminating the storehouse of information which it contains. Rather, it provides fundamental information about job situations and future outlook which users can apply to the advantage of individuals as they make career choices.

Professionally trained people who utilize the Handbook will interpret its content in the light of industrial developments and shifting economic conditions within local areas, specific regions, and throughout the Nation. Constant study of economic developments and the utilization of information from all sources, particularly local and regional employment offices, will provide valuable supplementary data in aiding individuals to make occupational decisions.

For these and other reasons, the Handbook fills a real need in assisting counselors to pinpoint trends and to make interpretations which will aid youth materially in structuring consistent and realistic plans for the future. While the Handbook provides data on national trends, counselors and other professional people will be careful to use these data in the light of information upon specific conditions in local areas.

Use by Teachers of Occupations

A teacher of occupations will find that the general plan of the Handbook makes it possible to provide an overview of the major occupational groups and the dominant trends in particular occupations. In addition, the specifics regarding trends and outlook are available so that the Handbook serves the purpose of aiding the teacher of occupations in providing students with both general and specific information related to an area of work. The teacher, no doubt, will wish to secure information about local and regional trends through such resources as the school counselor and other agencies within the community. Since the occupations teacher fully realizes the fluctuant nature of occupational information, he will impress upon students the necessity of including all local findings in any study of a particular area of work.

Use by Counselees

The Handbook makes its leading contribution to the counselee as he sets up a design of long-term plans. At this stage in his high school career, the student is forced to project his thinking and make some long-term decisions. He must be able to determine the types of professional

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preparation required if his occupational aspirations indicate the need for such training. If his proposed occupation requires professional preparation, he should have information on internships required and their availability. If his interests point toward technical training, he should explore apprenticeship requirements, the value of formal courses, and the extent to which on-the-job training supplements, or in some instances supplants, formalized training. In this kind of setting, the national data are most helpful in answering questions and in assisting the student to determine whether he will be confronted with the need to make a change in geographical location to secure employment in his chosen field. The Handbook figures will prove valuable in providing clues for determining the regional location of greatest demand for individuals with the skills he aims to acquire. While most students in high school may be able to make use of the Handbook, the teacher of occupations and the counselor can aid them in simplifying and interpreting the facts of pertinence to their long-range planning.

Use by Counselors

The counselor, perhaps, will find the greatest number of uses for the Handbook. During this period of manpower shortages in certain key occupations, the information provided will aid the counselor in assisting the counselee to evaluate the pressures for recruitment into various occupational groups, and to weigh these in the light of actual needs and realistic planning. Decisions can then be made, in the light of the opportunities available, to utilize fully the skills and aptitudes of the counselee. While most counselors have had some nonteaching work experience, it is unfair to assume that they possess detailed and accurate information on a large number of the jobs described in the Handbook. Therefore, the volume is a valuable tool in supplementing the occupational information which the counselor already has available from his experience, his knowledge of the work world, and his more intensive study of particular occupational fields.

Use by Counselor Trainers

The tentative nature of information about occupations, together with the fact that numerous changes mentioned earlier materially affect job opportunities and trends, makes the counselor trainer's course on occupational information a most difficult one to teach realistically. By utilizing the Handbook, the counselor trainer has at his disposal an arsenal of facts which will enable him to increase the proficiency of the counselor-in-training in a field which requires constant reevaluation and reorientation. By concentrating on how to use the facts available, rather than amassing information on a few occupations, the prospective counselor is placed in a position to organize the information needed for counseling his students more effectively and more beneficially. In this connection, it is scarcely necessary to say that many of the books furnishing occupational facts become obsolete almost as soon as they are printed. By emphasizing the procedure of studying an occupation by use of the Handbook and other relevant information, the counselor trainer provides the counselor with valuable techniques which do not become obsolete as economic conditions change.

Use in Gathering Information on Occupations

Many factors in the dynamic economy found in the United States contribute to a confusing pattern of job possibilities as teachers of occupations, counselors, or counselor trainers aid individuals in gathering pertinent information upon occupational opportunities. These can best be integrated if the resources of the Handbook are utilized to aid individuals in the analysis and interpretation of facts available through the Handbook. While the national scene is more stable than local and regional situations, users of the Handbook will find that local figures become meaningful only as national facts are applied to any one local setting. Gathering facts pertaining to occupations is a challenging process which is essential if students are to find helpful and significant assistance as they make occupational choices.

FRANK L. SIEVERS, *Chief*
Guidance, Counseling, and Testing Section,
Office of Education, U. S. Department
of Health, Education, and Welfare

Guide to the Handbook

This book answers many questions people ask when they are interested in choosing an occupation. It gives information on about 600 occupations—on the employment outlook in each of these fields, the nature of the work, training, and other qualifications needed for entry, lines of advancement, where jobs are located, and earnings and working conditions.

How the Handbook Is Organized

Introductory Chapters

The Handbook starts off with four introductory chapters, designed to help counselors and young people make effective use of the book and to give them a general view of the world of work.

The Guide to the Handbook, which forms the present chapter, describes the contents and organization of the book. It tells how the information was assembled and discusses a number of points which need to be borne in mind in interpreting the statements made. The second introductory chapter gives suggestions regarding supplementary sources of occupational information and tells how readers can keep up to date on developments affecting the employment outlook in different occupations. This chapter also contains a brief description of the counseling, placement, and other services available to job seekers at local offices of State employment services affiliated with the U.S. Employment Service. The other two introductory chapters describe the main trends in population and employment and give a general picture of the earnings of workers in the United States.

Occupational Reports

The reports on different fields of work follow the introductory chapters just mentioned and make up the main body of the book. They are arranged in chapters dealing with groups of related occupations. These chapters are grouped, in turn, into six major divisions of the book: professional, administrative, and related occupations; clerical, sales, and service occupations; skilled trades and other industrial occupations; some major industries and their occupations; occupations in agriculture; and occupations in government.

Indexes and Appendix

To help readers locate information on the occupations in which they are interested, a list of the occupational reports is included in the table of contents at the front of the book. Persons wishing to find statements on occupations related to a general field of interest—for example, artistic, technical, managerial, clerical, or manipulative work—may do so by referring to the Index to Occupations Classified by Broad Fields of Work (the first of the two indexes at the back of the book). The second index lists occupations and industries alphabetically, for quick reference.

The Technical Appendix (p. 759) contains a discussion of the sources and methods used in analyzing the occupational outlook in different fields of work. It is designed for readers wishing more information on this subject than is included in the present chapter. The appendix also contains an explanation of the D.O.T. numbers which are given in the occupational reports to indicate where each occupation fits into the classification system of the Dictionary of Occupational Titles.

Some Important Facts About the Occupational Reports

Occupations Covered

The more than 600 occupations discussed in this book include those of greatest interest to young people. Most of the large ones requiring long periods of education or training are discussed as are a number of small but rapidly growing fields and other occupations of special interest for various reasons. Altogether, the occupations covered account for about 90 percent of all workers in professional and related occupations; 90 percent of those in sales occupations; 80 percent in skilled occupations; 55 percent in clerical occupations; 55 percent in service occupations (except in private households); and smaller proportions in administrative and semiskilled occupations. The main types of farming are also discussed.

General information on many fields of work not covered in the occupational reports is contained in the introductions to several major divisions of the book—those on professional, administrative, and related occupations; clerical, sales, and service occupations; and skilled trades and other industrial occupations. These introductions also provide background information designed to aid the reader in interpreting the reports on individual occupations.

Sources of Information

A great variety of sources were drawn upon for information on employment trends and outlook and the many related topics discussed in the occupational reports. The Bureau of Labor Statistics supplied a large part of the data on employment in different industries, productivity and technological developments, wages and working conditions, trade union agreements, accident hazards, and a number of other items. Other agencies of the Federal Government—among them, the Department of Labor's Bureaus of Apprenticeship and Training and of Employment Security, the Bureau of the Census of the Department of Commerce, the Office of Education of the Department of Health, Education, and Welfare, the Civil Service Commission, the Interstate Commerce Commission, the Civil Aeronautics Administration, and the Federal Communications Commission—provided additional data regarding the nature of the work in various occupations, training and licensing requirements, wages, and employment trends. Many other public and private organizations—including State licensing boards, educational institutions, business firms, professional societies, trade associations, and trade unions—also made available published and unpublished data and supplied much helpful information through interviews.

By bringing together and analyzing information from these many sources, conclusions were reached as to prospective employment trends in the occupations covered by this Handbook. In addition, estimates were made of the numbers of job openings which will be created by retirements and deaths. The supply of new workers likely to be available in particular fields was also analyzed, by studying statistics on high school and college enrollments and graduations and data on the numbers of apprentices in skilled trades.

When preliminary drafts of the occupational reports had been completed, these were reviewed by officials of leading companies, trade associations, trade unions, professional societies, and other experts. The information and conclusions presented in each report thus reflect the knowledge and judgment not only of the Bureau of Labor Statistics staff but also of leaders in the field discussed, although the Bureau, of course, takes full responsibility for all statements made.

Points To Bear in Mind in Using the Reports

In using the information about employment prospects in this book, it is important to keep in mind that all conclusions about the economic future necessarily rest on certain assumptions. The statements on employment outlook in the Handbook assume that: (1) there will not be a war; (2) the defense program will be continued at about the same level as in late 1958; and (3) the general level of business activity will be high and unemployment low in the United States—that any economic recessions will be minor ones of short duration.

A catastrophe such as a war or a severe economic depression would, of course, create an employment situation entirely different from that likely to develop under the assumed conditions. Young people cannot build their lifetime plans in expectation of such unpredictable catastrophes, however. For practical purposes in vocational guidance, the assumptions made are believed to provide the most useful framework for analysis.

To avoid constant repetition, the assumptions are seldom mentioned in the reports on the many fields of work where the impact of a general decline in business or a change in the scale of mobilization would probably be about the same in the economy as a whole. On the other hand, in the statements on occupations where employment tends either to be unusually stable or to be especially subject to ups and downs, these facts are indicated. Even in the latter occupations, however, long-term trends in employment are more important than short-run fluctuations in appraising the outlook in connection with an individual's choice of a lifetime career.

It should be noted also that the picture of employment opportunities given in this book applies to the country as a whole unless otherwise indicated. People who want supplementary information on job opportunities in their communities should consult local sources of information, as suggested in the following chapter of the Handbook.

The information presented on earnings and working conditions, as on other subjects, represents the most recent available when the Handbook was prepared for the printer early in 1959. Much of the information came from Bureau of Labor Statistics surveys, but many other sources were utilized also. For this reason, the earnings data presented in the various occupational reports often refer to different periods of time, cover varying geographic areas, and represent different kinds of statistical measures. Comparisons between the earnings data for different occupations should, therefore, be made with great caution. However, the general picture of earnings in the United States given in the chapter on Earnings from Work should provide a useful frame of reference in interpreting the earnings data for a particular field of work.

Finally, it should be borne in mind that information on occupations and the employment opportunities they offer is only part of that needed in a career decision, which means matching a person and an occupation. The other part relates, of course, to the potential worker himself—his interests and aptitudes. People can obtain help in assessing their own abilities and interests and in selecting the occupation for which they are best suited from vocational counselors in schools and colleges, State employment service offices, Veterans Administration regional offices and guidance centers, and many community agencies.

Where To Go for More Information or Assistance

Persons using this Handbook may want more detailed data on some of the occupations discussed in the occupational reports, or information on fields of work which could not be covered there.

Suggestions as to sources of additional information on the occupations discussed are given in most of the occupational reports. In addition, several publications of the U.S. Department of Labor, listed on page 784 of this Handbook, provide further information on topics such as earnings and hours of work. Other sources likely to be helpful include the following:

Public Libraries

These libraries usually have on their shelves many books, pamphlets, and magazine articles giving information about different occupations. They may also have several books and current indexes which list the great numbers of publications on occupations and they may be of assistance in finding the best ones on a particular field of work.

Schools

School libraries often have the same kinds of reading materials on occupations. In addition, school counselors and teachers usually know about any local occupational information which has been assembled through special surveys made by schools or by other community agencies. Teachers of special subjects such as music, printing, and shorthand can often give information about occupations related to the subjects they teach.

State Employment Services

Counselors in local public employment offices are in a particularly good position to supply information about job opportunities, hiring standards, and wages in their localities. (These and other services available through the public employment service are described in the concluding section of this chapter.)

Business Establishments

Employers and personnel officers can usually supply information about the nature of the work done by employees in their industry or business, the qualifications needed for various jobs, and other facts about employment conditions and opportunities. The names of local firms in a particular industry can be found in classified sections of telephone directories or can be obtained from chambers of commerce.

Trade Unions, Employers' Associations, and Professional Societies

Frequently, these organizations have local branches, with officials who can supply information relating to the occupations with which they are concerned.

Keeping Up To Date on the Occupational Outlook

The present edition of the Handbook, like all previous editions, incorporates the most recent occupational information available when the book was prepared for publication, early in 1959.

The Bureau of Labor Statistics also issues a periodical, the Occupational Outlook Quarterly, to keep readers up to date between editions of the Handbook, on developments affecting employment opportunities and on the results of new occupational outlook research. In addition, the Bureau issues at irregular intervals occupational outlook bulletins which give much more detailed information on various fields of work than can be included either in the Handbook or in the Occupational Outlook Quarterly. Further information about these publications, and directions for ordering them, will be found on page 784 of the Handbook.

The Bureau will be glad to place the name of any user of this Handbook on its mailing list to receive announcements of new publications and releases summarizing the results of new studies. Anyone wishing to receive such materials should send the request, with his address, to the Bureau of Labor Statistics, U.S. Department of Labor, Washington 25, D.C.

Services to Jobseekers at Public Employment Offices*

Many of the readers of this Handbook want assistance in choosing a suitable type of work and in finding the right job. The reader who wants professional assistance from trained counselors and help in obtaining the right job should know about the services offered by his local public employment office.

The U.S. Employment Service and affiliated State employment services form a nationwide organization which plays an important part in our economy. Through 1,800 local offices, conveniently located in cities and towns throughout the United States, this employment service finds jobs for workers and workers for jobs.

Although the employment service is a Federal-State system, each employment office is basically a local community organization. It is concerned with facilitating suitable and stable employment for the community's working population and with adequately meeting the manpower needs of its employers. And because of this concern, the local office tries to do more than simply refer a worker to a job—it tries to match the worker and job so that the requirements of each are satisfied. To do this, the public employment office has developed a number of services that are available to all job seekers. Many of them are particularly important to young men and women about to enter the world of work.

Counseling Services

Employment service counseling assists both young people leaving school and experienced workers who wish or need to change their field of work in choosing and adjusting to a suitable field of work.

The major purposes of employment counseling are to help people to gain insight into their actual or potential abilities, their interests, and their personal traits; to understand something of the nature of the world of work; and to make the best use of their capacities and preferences in the light of available job opportunities.

In the employment service, the counselor has at his fingertips a vast store of resources, including testing facilities and labor market and occupational information.

Testing. Most local offices provide testing services, including the General Aptitude Test Battery, which measures basic abilities for many and varied broad fields of work and for about 600 specific jobs within these fields. These tests help the applicant appraise his abilities. They may reveal aptitudes the job seeker did not know he had.

Labor Market Information. The State employment office counselor has information about jobs in the community. He knows what kinds of jobs prevail in local industry, which jobs are more plentiful, what the hiring requirements and the opportunities for promotion are, and what the jobs pay. In many labor market areas, the counselor has information about future occupational opportunities based on area skill surveys which usually cover employers' forecasts of their long-range requirements. He may also have detailed occupational guides covering specific jobs in the community. In addition, since his office is a part of the nationwide employment service, it has information regarding employment opportunities in other areas all over the country.

Occupational Information. The employment service office has occupational information which helps the job applicant decide whether he is suited to a particular kind of work. The Dictionary of Occupational Titles, Job Descriptions, Estimates

*Prepared by the Bureau of Employment Security, U.S. Department of Labor.

of Worker Traits for 4,000 Jobs, and other tools describe the work performed in the various occupations and the training required, lines of advancement, physical demands, and working conditions for most occupations.

Cooperative Arrangements With Other Community Groups. Local employment office counselors work closely with other public and private agencies and organizations which provide special services that the job seeker may need in order to become better prepared for employment. These groups include educational, training, vocational rehabilitation, and health and welfare agencies.

Placement Assistance

The primary objectives of the placement service in the local employment office are to fill employers' job openings with occupationally qualified workers and to locate employment for workers (including claimants for unemployment insurance) which is suited to their skills, knowledge, and abilities. The employment office placement service is designed to eliminate the waste of "hit-or-miss" job hunting.

Local Openings. State employment office personnel maintain regular contacts with local employers and know their hiring needs and their jobs. Placement interviewers receive requests from employers for all kinds of workers. Through the local office, therefore, the job applicant has access to a variety of job vacancies with many employers, just as the employer has access to many applicants. When no suitable job exists for an individual worker, the employment service may attempt to solicit an opening for him from likely employers.

Jobs Throughout the Country. The job clearance system of the nationwide network of State employment offices offers the applicant an opportunity to qualify for jobs outside his area, elsewhere in the State and the Nation, and even in foreign countries. Each State employment service prepares frequent inventories of hard-to-fill jobs which are distributed to all other State employment services. This makes it possible for them to refer local workers to out-of-area jobs for which they qualify. In addition, a national network of highly specialized professional placement offices has been established with the State employment service in order to speed the matching of jobs and applicants in professional fields.

Placement Aids. As in counseling, the information on local job opportunities for industries, occupations, and areas, and on occupational requirements which is available in the employment offices contributes greatly to getting the right job for the worker and the right worker for the job. Also available to the job seeker are aptitude and proficiency tests which help determine whether an applicant is qualified to perform satisfactorily on specific jobs.

Services to Special Worker Groups

The employment service has developed techniques and procedures for particular applicant groups who may encounter special problems in their search for suitable jobs.

Special services to youths include emphasis on counseling graduating students and school dropouts, and intensive efforts to promote employment opportunities for them. In many cities, employment service offices have cooperative arrangements with high schools to provide counseling, testing, occupational information, and placement services to students prior to their graduation as well as to other school leavers. Such arrangements were in effect in over 8,000 high schools in the school year 1957–58.

The State employment offices have long maintained an active program for helping applicants with vocational handicaps. The emphasis is on what these people can do with their abilities rather than on what they cannot do because of a disability.

Special services for veterans are provided by the employment service. In each local office, there is a veterans' representative who is trained to know veterans' rights and benefits and who carries on job promotion for veterans. In order to speed their readjustment to civilian life, the State employment services provide information service to veterans at military separation and transfer points.

The employment service also has developed techniques to deal with job problems of middle-aged and older workers. Special attention is being given to assisting them to make realistic job choices. Employers have been encouraged to remove age hiring restrictions and to hire only according to the qualifications of the individual.

Similar attention is also being given to job problems of members of minority groups and others facing special difficulties in obtaining suitable employment.

How To Locate the Local Employment Office

The addresses and telephone numbers of local offices of State employment services affiliated with the U.S. Employment Service may be found in local telephone directories. Jobseekers, employers, schools, and public and private agencies aiding clients to find employment are invited to utilize the services of the public employment offices in their communities and to avail themselves of the fund of job information maintained in these offices.

Economic and Occupational Trends

Everyone concerned with the problem of choosing an occupation or advising others in this important decision should keep uppermost in his mind the rapidly changing nature of our economic world. New ways of making things, new things to make, and new patterns of living are continually causing changes in the kinds of jobs that workers perform. When a boy leaves school today, he may look for many types of jobs which did not exist 50 years ago—for example, electronic technician or airplane mechanic. On the other hand, he has probably never heard of the occupations of cooper and wheelwright, which not so long ago were large and well-paid trades.

The rapidity with which the occupational picture can change may be seen by comparing employment trends since 1920 in two well-known occupations—electricians and railroad engineers. While one occupation declined the other expanded; the number of railroad engineers has declined by almost 40 percent and the number of electricians has increased by nearly 50 percent.

What caused this to happen? Because of the introduction of diesel engines and many other technological improvements, railroads today are much more efficient than they were in 1920 and are capable of hauling a given amount of traffic with fewer engineers. In addition, competing forms of transportation, such as private automobiles, trucks, airlines, and pipelines, have expanded greatly in the last 30 years. The demand for electricians, on the other hand, has increased sharply because of the growing use of electrical devices and electricity. In fact, the vast expansion in the use of electrical power has been one of the outstanding phenomena in the development of our Nation during this century.

In addition to the changing importance of certain occupations, many other facts about the nature of the work force should be considered in choosing a career. For example, American workers have a strong tendency to move geographically in the course of their work careers; about 2 million people in the labor force moved from one State to another between March 1957 and March 1958. The toal number of people who moved, including the families of these workers, was of course much greater. Altogether, 11 million people or about 7 percent of the population were living in a different county in March 1958 from the one they had been living in in March 1957, and about one-half of these were living in a different State. Nearly all such shifts involve a change in jobs and many represent a shift to another occupation. Added to this is the vast amount of job and occupation changing by people who do not change their place of residence.

Knowledge of these dynamic aspects of our economy is particularly important for young people so that they will expect changes and be prepared to adjust to them. They should be ready to move to other parts of the country and to change their jobs in order to improve their economic status, or to meet a change forced upon them by the loss of a job, poor health, or for other reasons. All of this suggests the great importance of maintaining the utmost flexibility by taking the broadest kind of training possible when preparing for a particular occupation. Furthermore, by studying some of the specific changing industrial and occupational trends that are occurring, it is possible to anticipate some future developments and be prepared to meet them.

To emphasize the changing character of occupational life, as well as to provide background for understanding the trends and outlook in particular occupations, the next few pages will review the growth and changing composition of the population and labor force, and the major trends in employment by broad industry and group occupation.

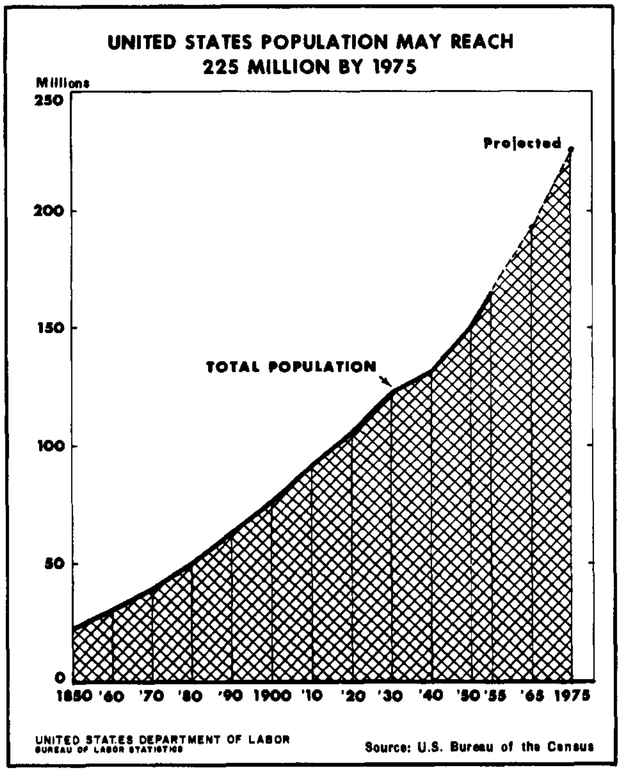
Population and Labor Force Trends

Population

The size and age structure of the population are important in determining how many and what kinds of jobs there will be, as well as the number of workers who will be available. In many occupations, such as teaching, police work, and health services, the number of jobs which will be available is directly related to population growth. Most occupations are not as directly affected as those mentioned, but employment opportunities in every occupation are, to some extent, influenced by population growth.

The population of our country has expanded enormously since Colonial days (chart 1). The growth was particularly rapid in the several decades preceding World War I when there was a combination of a high birth rate, large-scale immigration from European countries, and a sharp reduction in death rates. After World War I, the rate of population increase slackened because immigration was virtually stopped, and

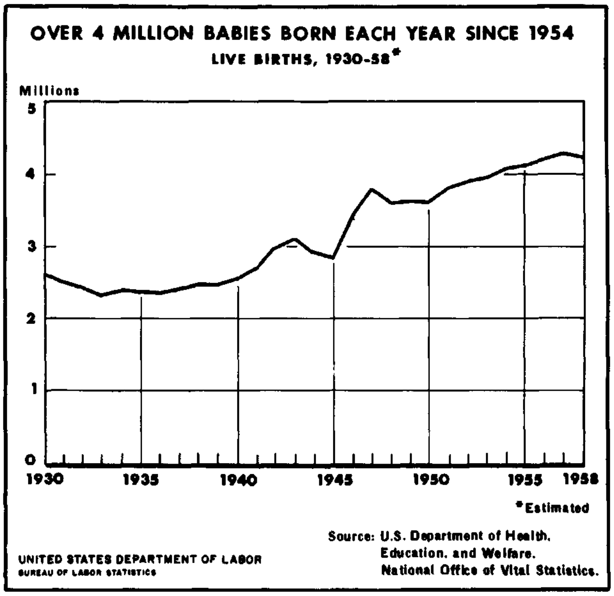
CHART 1



because the birth rate declined. During the depression years of the 1930's, there was an especially sharp decrease in marriages because of heavy unemployment, low incomes, and limited job opportunities.

World War II marked the end of the downturn in the rate of population growth. The number of births rose sharply during the early war years and then, after slackening briefly during 1944 and 1945 when millions of young men were overseas, mounted to extremely high levels (chart 2). The

CHART 2



number of babies born in 1947 was 3.8 million compared with an average of only 2.4 million during the period from 1935 through 1939. Since 1947, the annual number of births has remained high, reaching more than 4 million in 1954 and continuing at more than that number each year.

This spectacular jump in the number of babies born has had, and will continue to have, great effects on the outlook in many occupations. The first and perhaps the greatest impact was on the Nation's school system and the teaching profession. In 1945, there were only 19½ million children in the ages 5 to 13; by 1960, there will be about 33½ million children in this age group—a rise of 14 million or almost 75 percent in 15 years. Since nearly all children in these ages attend school, enrollment in elementary school has risen correspondingly. A sharp increase will also occur among 14- to 17-year-old persons, most of whom are in high school. This age group will increase from about 11 million in 1958 to 14 million in 1965 and to 16 million by 1970. The number of young persons of college age—18 to 21—will increase from 9 million in 1958 to 12 million in 1965 and to 15 million in 1970.

These enormous increases will, of course, profoundly affect the outlook for teachers at every level of education. A detailed discussion of how many elementary, secondary, and college teachers will be needed is presented on pages 40–52 in this book.

The very large numbers of babies born in the 10 years following World War II will reach the ages at which most young people get married, beginning in the late 1960's. Between 1958 and 1975, the number of persons aged 20 to 24 years is expected to increase from 11 million to 19½ million. As a result, demands for apartments, houses, furniture, washing machines, and children's clothing and food will be very high. These demands, in turn, will affect the employment opportunities in a great many occupations.

Another significant change in the age structure of the population is the continuing rise in the number of elderly persons. The number of persons 65 and over tripled between 1900 and 1940, while the total population did not even double. By 1975 there will be about 22 million persons aged 65 and over—an increase of nearly 55 percent in this age group over 1955.

Increases in the number of older persons will affect the outlook in many occupations. Increased demands are expected for medical services, for institutions to care for the aged, and generally for the types of goods and services which meet the needs of older persons.

Labor Force

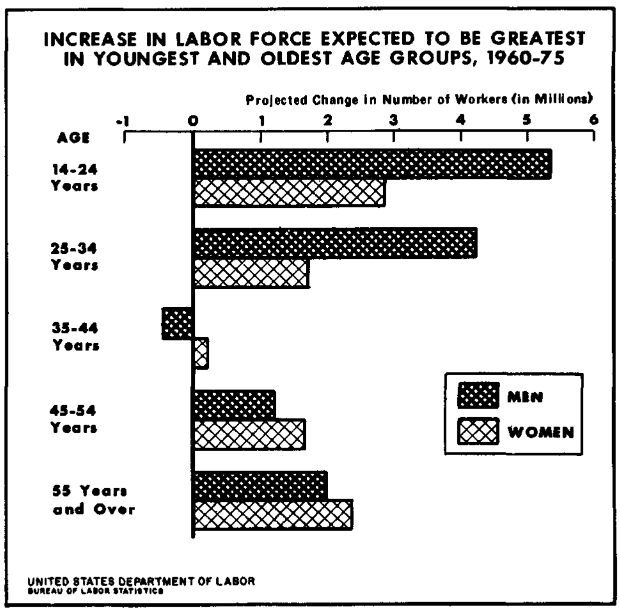
The preceding discussion shows how the changes in the structure of the population affect the demand for goods and services and, therefore, job opportunities. Another important aspect of changes in the age structure of the population is the effect on the supply of available workers, or the "labor force." The labor force includes employees who work for wages or salaries, farmers, self-employed businessmen, members of the Armed Forces, and persons who are unemployed and looking for work.

A summary picture of expected changes in the labor force between 1960 and 1975 is shown in chart 3. As is to be expected, because of a sharp rise of births after World War II, the greatest growth in the labor supply will come from workers under 35 years of age. The number of men workers aged 35–44 will actually decline owing to the sharp drop in births during the depression of the 1930's. Sizable increases are expected in the number of adult women workers and among men 55 years old and over.

Trends in Labor Force Participation. Between 1960 and 1970, the labor force will expand by about 13½ million. Most of this expansion will be the product of population growth. Some, however, is expected to occur as a result of the changing proportion of people in various age groups who work outside the home. In the following paragraphs we shall briefly describe the labor force trends of the important population groups.

First, let us consider the adult men under 65 years of age, who make up the great bulk of the labor force. Practically all of these men work, except for the very small proportion who are disabled or in bad health. Looking ahead to 1970,

CHART 3



we can expect very little change in the proportion of adult men in the labor force.

For adult women the story is different. Back in 1910, only about one woman out of every five was in the labor force, but by 1959, this proportion had risen to one out of three. Much of this increase, as already indicated, has taken place since World War II. There are a number of reasons why more and more women have taken jobs. The shift of population to the cities and the increased importance of occupations such as clerical work, selling, and teaching resulted in a great expansion of employment opportunities for women. At the same time, the introduction of labor-saving household devices made it possible for growing numbers of women to accept jobs outside the home. The trend toward increasing participation in the labor force is particularly strong among women 35 to 64 years old.

Among young people, on the other hand, the proportion that are workers has been dropping. The longer schooling required of today's youth has brought about delays in their entry into work careers and can be expected to continue to do so in the future. It is important to note, however, that although young people stay in school longer, the availability of job opportunities in recent years has encouraged many more students to take part-time jobs. Such part-time workers are counted in the statistics as "in the labor force." If they were excluded, the proportion of young people in the labor force would show an even greater decline than has occurred.

Men 65 and over comprise another group in which the working proportion has declined. This trend is undoubtedly related to the extension and improvement of public and private pension systems over the last 20 years. Because a growing number of people are assured of incomes after they pass 65, more have been able to retire from their jobs than previously. Nevertheless, the large increase in the number of older people in the population has resulted in a significant rise in the number of older workers.

Rising Educational Levels of the Labor Force. As has been indicated, the rapid growth of the work force has been accompanied by an increase in its training and knowledge which has greatly affected workers' capacity to produce. Nowadays, more young people are going to school and for longer periods than formerly. For example, in 1957, 38 percent of the people 25 to 34 years of age had completed high school, while only 14 percent of those 55 years of age and over had this much schooling. In 1958, one out of every six people 22 years of age or over had a bachelor's degree, compared with only 1 out of 50 in 1900. Two-thirds of the population 18 years of age in 1958 had completed high school, whereas only about 1 out of 15 in 1900 had done so.

Many factors have contributed to this rising educational level. Most States have raised the minimum age at which children may legally leave school. Both Federal and State laws prohibit the employment of young people under a minimum age and limit the kinds of work they may perform. Moreover, greater concentration of population in cities and metropolitan areas has made school more accessible to a much larger number of people. Higher family incomes have also enabled more students to remain in school longer than was possible when many youngsters had to go to work to help support their families.

Another factor is the increasing number and complexity of skills demanded in modern industry. To meet such requirements, employers have raised educational qualifications for many jobs, especially for the more desirable ones. These higher standards must be met not only by persons looking for work, but also by persons seeking promotions.

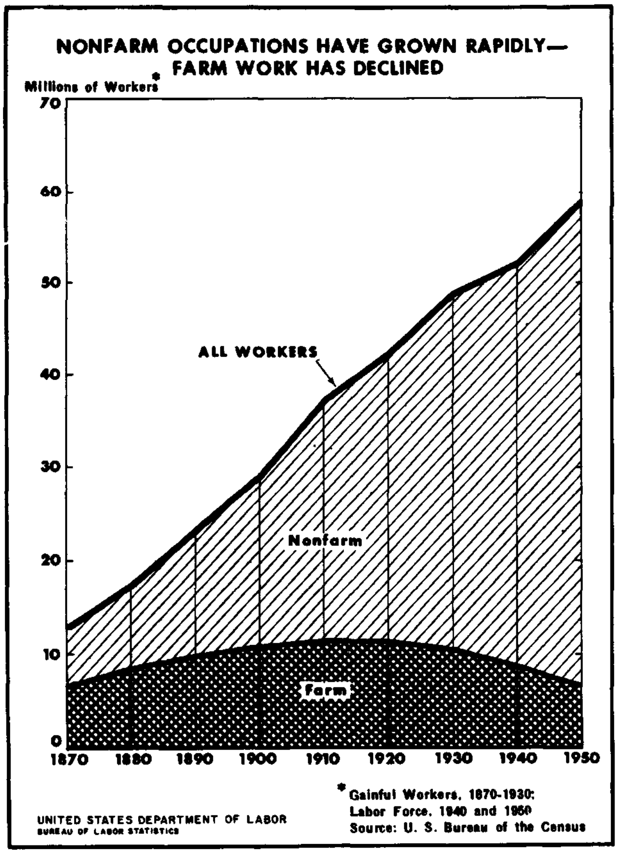
Industrial and Occupational Trends

The growth of the Nation's work force over the years has been accompanied by sharp changes in the relative size of different industries and occupations, which have greatly affected employment opportunities. New products and new ways of manufacturing products have marked the history of the country since Colonial days. Some products and services which were once of outstanding importance have declined and others have actually disappeared. For example, the carriage industry, the making of wood barrels, and passenger traffic on the Mississippi River System are only historical memories. Other industries which were unknown at the turn of the century are currently among the largest employers of manpower. Two of the most dramatic examples of new industries are aircraft and chemicals. Industries which have sprung into being recently and will be of growing importance in the future are those in atomic energy and in the production and servicing of electronic equipment of many kinds. Undoubtedly, there are other industries and occupations which are now so small that they have hardly been noticed but which will become major fields of employment in the years ahead.

Industrial Trends

Changes in Agricultural Employment. It is generally recognized that the greatest technological revolution in this country has taken place on the farms. In 1870, more than one-half of the people who worked for a living were employed in agriculture. Today, only 1 worker in 10 makes his living from farming. The implications of this fact are enormous. Ninety years ago, the average farmer could supply food for only about six people; today one farmer meets the food needs of 30 people.

CHART 4



By comparing a farm of 1870 with one of today we can readily see why this has been possible. The farmer has machinery which enables him to put into use several times the productive acreage that a man could handle in 1870. Moreover, the replacement of horses and mules by tractors and trucks in both the city and the farm freed millions of acres for the production of food for human beings instead of for livestock. The use of scientific methods, chemicals, fertilizers, better seeds, and improved cattle and hogs have also greatly increased farm productivity. The results of this technological revolution—in freeing millions of workers for nonfarm employment—are shown in chart 4. The number of farmers and farm workers increased from about 7 million (53 percent of the work force) in 1870 to a peak of 11½ million around 1910, but then declined to about 7½ million (12 percent of the work force) in 1950. Farm employment has continued to decline since 1950.

Changes in Nonagricultural Employment. Nonagricultural workers in the United States are classified in eight major industry divisions—mining, manufacturing, construction, transportation and public utilities, trade, finance, service, and government. The longrun employment trends in these different industry divisions can be seen by reviewing their employment up to 1957—before the general employment picture was significantly affected by the recent business recession.

The total number of workers in nonagricultural industries almost doubled between 1919 and 1957, but employment rose much faster in some major industry divisions than in others. The trade and service industry divisions increased their work force more rapidly than total nonagricultural employment. Transportation and public utilities showed a smaller increase in employment than most other industry divisions; mining employment actually declined during this period. In contract construction, employment fluctuated sharply with changes in general business conditions—but this has been the fastest growing industry division in the period since World War II.

Employment in manufacturing, while fluctuating in response to changing economic conditions and defense mobilization, showed much slower growth than total nonagricultural employment over the 1947–57 decade.

A brief look at some important aspects of each broad industry group will help to show the kinds of employment opportunities available in each. It will also make still clearer the need for counselors and students to keep in mind the changing nature of the economy.

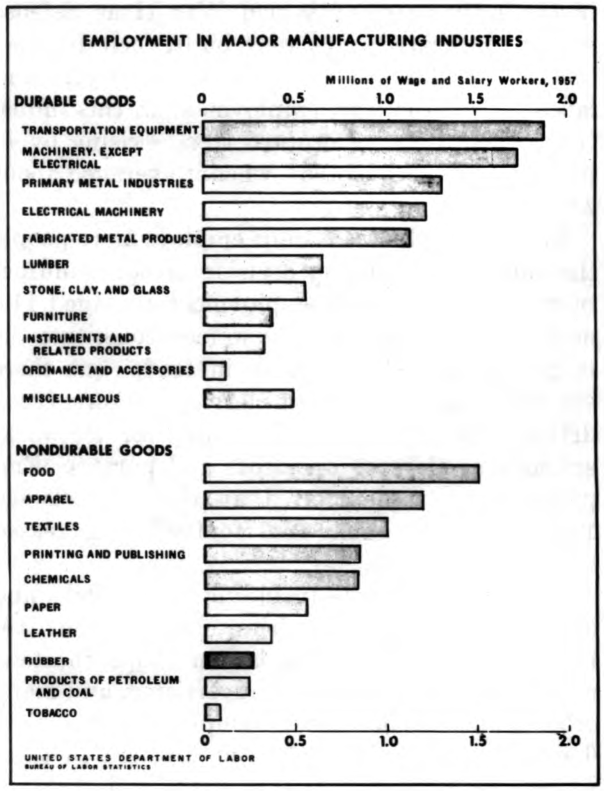
Manufacturing industries—with almost 17 million workers in 1957—employ more people than any other industry division. They offer jobs to many different kinds of workers—the unskilled laborer, the machinist, the engineer, the stenographer, the production manager, as well as the operatives or semiskilled workers. Nearly half of all employees in manufacturing industries in 1950 were operatives.

Factory employment has not yet risen as high as it did at the peak in World War II and has fluctuated widely since the end of the war. It appears, however, that underlying these fluctuations has been a slowly rising trend in factory employment. The likelihood is that this trend will persist during the next few decades—that there will be a moderate continued growth in manufacturing employment, although factory production will rise even faster because of further technological advances and a consequent rise in productivity. However, as in the past, there will be varying trends in employment and productivity in different manufacturing industries.

One of the major shifts in manufacturing employment in recent years has been from non-durable goods industries (for example, food, tobacco, and textiles) to durable goods industries (e.g., electronic equipment and machinery). Employment in the durable goods industries increased by 17 percent between 1947 and 1957, whereas employment in the nondurable goods industries rose by less than 1 percent. Textiles, apparel, and food, in the nondurable goods group, employed about one out of every five factory workers in 1957, as against more than one out of every four in 1947. In both food and textiles, the number of jobs actually declined over the 10-year period. Of the nondurable goods industries, employment in only paper, printing, and chemicals grew as fast as did employment in the durable goods industries as a whole.

Most of the employment increase in the durable goods industries occurred in electrical machinery, transportation equipment (mainly motor vehicles and aircraft), and scientific instruments. These industries employed about 20 percent of all factory workers in 1957, as compared with 16 percent in 1947. The major manufacturing industries and their relative importance as a source of employment are shown in chart 5.

CHART 5



In mining—the only major industry division to show a decrease in number of workers—employment declined by 28 percent from 1919 to 1957, when it averaged about 800,000. This decline, persistent over the past 35 years, reduced mining employment from a little more than 4 percent to less than 2 percent of all nonagricultural employment.

The overall decrease in mining employment does not reveal the divergent trends in employment among the individual mining industries, however. Between 1947 and 1957, employment declined 64 percent in anthracite mining and 46 percent in bituminous coal mining; but metal mining increased 8 percent; nonmetallic mining and quarrying, 16 percent; and petroleum and natural gas production, 38 percent.

Employment in the construction industry has fluctuated greatly in past decades. When general business conditions are good, people buy new homes and companies invest in new plants; in bad times, families and business firms put off spending that can be postponed. Construction employment dropped by 46 percent between 1929 and 1933, rose slowly in the late 1930's, expanded sharply in the early years of World War II as defense plants and army camps were built, then dropped because of wartime shortages of materials and labor. After the war, employment in this industry showed a strong upward trend—rising by 40 percent from 1947 to 1957, when it averaged about 2.8 million.

Retail and wholesale trade employs more people than any other industry division except manufacturing. In 1957, trade employment averaged 11.3 million. Salesmen and saleswomen constitute the largest group of employees in trade, but there are also large numbers of clerical workers, truck drivers, delivery men, and building service workers such as elevator operators and porters. Employment in trade more than doubled between 1919 and 1957. From 1947 to 1957, it increased by over 20 percent.

Service industries—including automobile and other repair shops, laundries, cleaning and dyeing establishments, hotels, barber shops, theaters, motion-picture production, advertising, and many other kinds of businesses—employed more than 6 million people in 1957. Employment in these industries tripled between 1919 and 1957—a more rapid increase than occurred in any other industry division. It has climbed steadily since World War II, rising by over 30 percent from 1947 to 1957.

In State and local governments, the long-range trend of employment has been upward. About 5,900,000 people were working for State and local governments in 1957—roughly three times as many as in 1920. In the post-World War II period, from 1946 to 1958, employment in government agencies increased by two-thirds. This rise in employment has been due to the increase in schools, public health and sanitation, welfare work, and similar activities.

In the past, Federal Government employment has not shown a steady rise, but rather has been sharply affected by national emergencies. For example, World War II brought a rise in Federal employment from about 1 million in 1940 to a record high of approximately 2.9 million in 1944. Again, during the Korean crisis, employment rose from about 1.9 million in 1950 to 2.4 million in 1952. Between 1953 (the end of the Korean hostilities) and 1957, employment remained relatively stable, averaging about 2.2 million.

Employment in finance, insurance, and real estate more than doubled from 1919 to 1957, reaching about 2.3 million in 1957. From 1947 to 1957, employment in this industry division rose by 40 percent, reflecting increased activity in the real estate field, increasing purchases of insurance and stocks and bonds, and expanded use of banking facilities. Clerical occupations are the predominant ones in this industry division. These industries, however, also have a large number of sales personnel. A high proportion—nearly half—of all workers in the finance, insurance, and real estate field are women, including a great number in clerical jobs in insurance companies and banks. Many of the men in this general field are insurance and real estate agents.

Over 4 million workers were employed in transportation and public utilities in 1957. The largest industries in this broad group are the railroads, trucking companies, bus and transit lines, telephone and electric power companies, and merchant marine. Airlines and radio and television broadcasting companies employ fewer workers, but offer opportunities in many specialized occupations of considerable interest to young people. In the industry division as a whole, the great majority of the workers are men, who are employed in a variety of occupations such as those of locomotive engineers, truckdrivers, linemen, engineers, seamen, ticket agents, and Pullman porters. Most of the women in these industries are clerical workers.

Although employment in this group of industries as a whole has not changed much in recent years, some industries in the group have declined while others have shown marked growth. Thus, employment on interstate railroads, still the biggest transportation industry, fell 28 percent from 1947 to 1957, and employment in buslines and local railways dropped 44 percent. On the other hand, increases occurred in trucking and warehousing, where employment rose by 47 percent and, above all, in air transportation, where the employment gain was 77 percent.

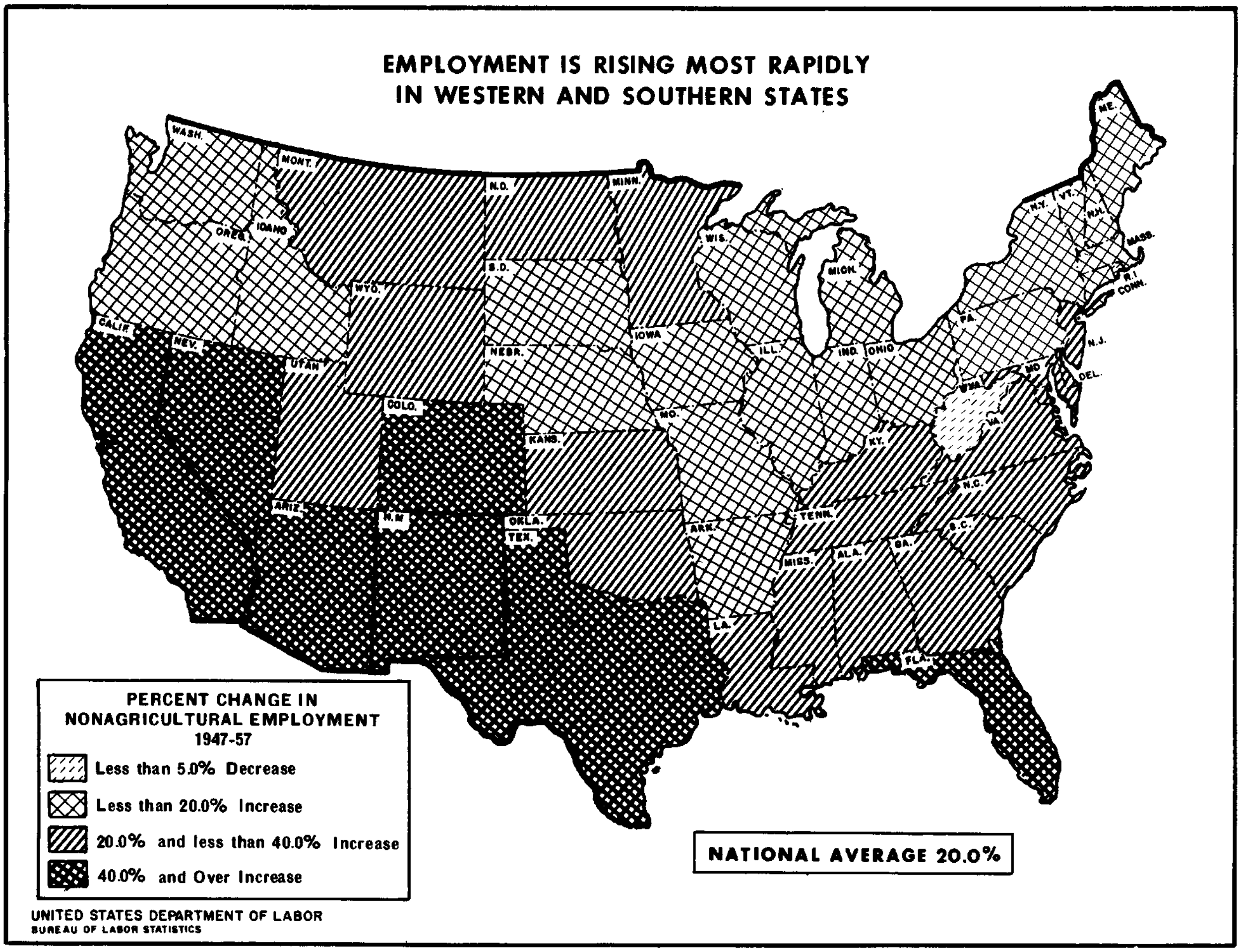
Geographic Shifts in Employment. The increases in employment which have taken place in this country since World War II have extended to all but two States (Rhode Island and West Virginia). The rate of growth has, however, been much faster in some parts of the country than others.

The most dramatic growth occurred throughout the Southwest. (See chart 6.) Six States in this area—California, Nevada, Arizona, Colorado, New Mexico, and Texas—had employment increases at rates more than double that of the Nation as a whole. Texas and California had a combined increase of more than two million jobs. The Southeastern States also showed growth rates well above the national level. Leading this area was Florida, where nonagricultural employment increased by half a million, or about 80 percent.

New England and the Middle Atlantic States (New York, New Jersey, and Pennsylvania) are the parts of the country where employment has increased most slowly in recent years. The rate of growth in employment was substantially below the national average between 1947 and 1957 in all States in these regions except New Jersey, where the rise approximately equaled the national rate.

In the East North Central region (Wisconsin, Illinois, Michigan, Indiana, and Ohio) and the West North Central region (North Dakota, South

CHART 6



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Dakota, Minnesota, Nebraska, Iowa, Kansas, and Missouri), only three States, North Dakota, Minnesota, and Kansas, had employment gains equal to or higher than the national average rate for 1947–57. In the Northwestern States (Washington, Oregon, Idaho, Montana, and Wyoming) the rate of increase in employment was generally about the same as the national average.

The rapid expansion of employment in the Western and Southern parts of the country began during the Second World War. In 1939, the Middle Atlantic region accounted for the largest proportion of employment in each of the eight major industry divisions. During the war, the East North Central States took the lead in manufacturing employment and, by 1953, this region also had the largest proportion of construction jobs. The center of mining employment by 1953 had shifted from the coal-producing Middle Atlantic to the petroleum and gas-producing States of Texas, Louisiana, and Oklahoma.

In finance, trade, service, and government, employment increases throughout the South and the West were again well above the national level. The most rapid increases in each of these four industry divisions occurred in the Rocky Mountain region (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada.) The expansion of defense installations in many of the Southern and Western States has stimulated trade and real estate activities, while the increasing popularity of many resort and tourist centers in these areas has led to increased employment in hotels, restaurants, and other service industries.

Despite these significant shifts in the location of industry—generally to the South and West—it is important to note that the basic geographic structure of American industry is still very much as it was a decade ago. The concentration of industry and commerce, along with population and labor supply, remains to a significant extent in the regions and States where it was at the end of World War II. One out of every three manufacturing jobs is still located in the nine States comprising the New England and Middle Atlantic regions. In other industries similar concentrations remain. The geographic area comprising the New England, Middle Atlantic, East North Central and West North Central regions still employs about 6 out of every 10 of the Nation's workers in trade, finance, service, and transportation industries and over half of those in construction and government. Only in mining and related employment has the rest of the country surpassed these four regions, employing about 7 out of every 10 workers in mining, petroleum production, and other extractive industries.

Effect of Recessions on Employment and Career Planning. Since the end of World War II, the country has had full or nearly full employment in most years. However, even during this period of general prosperity, conditions have varied from year to year. The most recent temporary decline in economic activity began late in 1957 and continued until the spring of 1958, when employment began to pick up again. The recovery was rapid between April and September 1958, but slowed down in the fall and winter. In early 1959, the recovery was still proceeding slowly. Recessions, each lasting about a year, also occurred in 1949–50 and in 1953–54. These recessions do not appear to have had more than a temporary effect upon long-term employment trends.

Because a young person choosing a career should make plans that will serve his best interest during his entire working life, his emphasis should be on the long-term outlook—rather than on the immediate, and possibly temporary, economic situations that confront him when he is planning for the future. Nevertheless, recessions do have varying effects on employment in different industries and occupations and young people and their counselors should be aware of them.

One of the most important conclusions that may be drawn from studying the employment effects of recent recessions is that some industries are likely to be hit hard, while a few appear to be virtually recession proof. Manufacturing, mining, transportation and, to a lesser extent, construction tend to have the widest fluctuations in employment. On the other hand, service, finance, and, to some extent, trade have shown considerable resistance to the effects of economic downturns. Government employment, especially State and local, has been affected very little by the recessions.

Within manufacturing industries, the recessions have been felt most severely by the durable goods industries. There are several reasons for this. Often, the contraction in business activity is associated with cuts in capital goods expenditures (industry spending for plants and equipment). These cuts affect mainly producers of durable goods, such as steel, machinery, transportation equipment, and fabricated metal products. Furthermore, when workers become unemployed, or when their paychecks are reduced by a shorter workweek, or even when they become apprehensive about the future, they usually attempt to maintain expenditures for food and clothing (nondurable goods), while often deferring expenditures for new automobiles, washing machines, television sets, and similar equipment (durable goods). In addition, purchases of new homes often decline during periods of economic recessions, and construction employment drops. This cutback in construction further aggravates the decline in durable goods manufacturing industries, since fewer new homes mean less demand for all of the durable equipment that goes into a new house—such as refrigerators, stoves, furnaces, plumbing equipment, and so forth.

Why then, should a young person consider a career in an industry—such as durable goods manufacturing—periodically subject to wide employment swings? There are several answers to this question—some personal, some economic. In selecting a field of work, a young person should, of course, seek one well suited to his particular aptitudes and interests, and sometimes personal considerations of this sort out-weigh economic factors. From an economic point of view, one important consideration is the rapid growth of the durable goods manufacturing industries in times of expanding employment. Young people tend to enter industries where jobs are most readily available. Since the end of World War II, there has been a rapid expansion in such durable goods industries as metals, electronics, electrical machinery, and aircraft. The nondurable goods industries have, with a few notable exceptions, been a much less dynamic sector of the economy over the last decade or so. For a number of years, industries such as food products, tobacco, textiles, rubber, and leather have grown very slowly, if at all.

Another important reason for choosing a career in the durable goods industries is the higher than average pay levels. Average hourly earnings were approximately 18 percent higher in durable goods than in nondurable goods industries in 1958. Of course, this general picture does not apply to every industry. Average hourly earnings in some durable goods industries (for example, lumber and furniture) are below the general average for all manufacturing industries. On the other hand, workers in some nondurable goods industries (such as petroleum and coal products, printing, chemicals, and rubber) have average hourly earnings well above the overall average. In general, however, earnings tend to be higher in durable goods than in nondurable goods industries, and the differential has widened over the past decade.

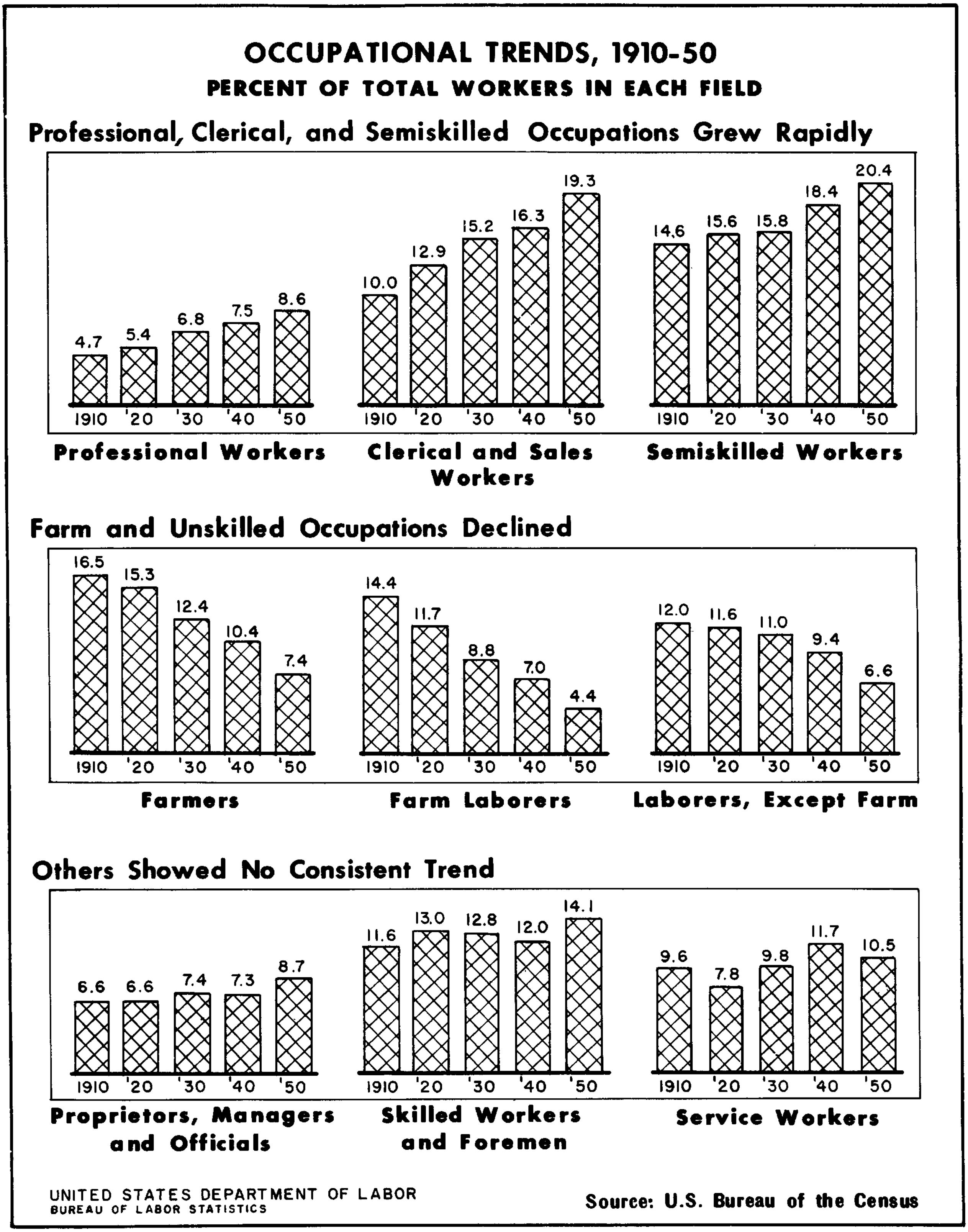
The conclusion to be drawn from these facts—that, in manufacturing, the industries where hourly earnings tend to be above average are also those with relatively unstable employment during recessions—holds true also for nonmanufacturing industries. Relatively larger cutbacks in employment during recessions occurred in railroads, mining, and contract construction than in finance, insurance, and real estate; the service industry group; communications and public utilities, and government. Furthermore, earnings tend to be higher in railroads, mining, and contract construction than in most of more stable industry groups.

Earnings and stability of employment depend, of course, not only on the industry in which the individual is employed but also on his occupation, degree of skill, and many other factors. For example, as manufacturing employment has dropped in periods of recession, production workers have been the group who have, in general, borne the brunt of the employment decline. In some industries, the number of nonproduction workers employed has continued to rise during recessions though more slowly than before; at worst, their employment has remained approximately stable. These nonproduction workers include engineers and other professional personnel, as well as clerical, sales, and administrative workers.

Occupational Trends

The growth of the Nation's working population and the varying trends of employment in different industries have led to major changes in the occupational distribution of the labor force. (See chart 7.)

CHART 7


OCCUPATIONAL TRENDS, 1910-50
PERCENT OF TOTAL WORKERS IN EACH FIELD
Professional, Clerical, and Semiskilled Occupations Grew Rapidly
4.7
5.4
6.8
7.5
8.6
1910 '20 '30 '40 '50
Professional Workers
10.0
12.9
15.2
16.3
19.3
1910 '20 '30 '40 '50
Clerical and Sales Workers
14.6
15.6
15.8
18.4
20.4
1910 '20 '30 '40 '50
Semiskilled Workers
Farm and Unskilled Occupations Declined
16.5
15.3
12.4
10.4
7.4
1910 '20 '30 '40 '50
Farmers
14.4
11.7
8.8
7.0
4.4
1910 '20 '30 '40 '50
Farm Laborers
12.0
11.6
11.0
9.4
6.6
1910 '20 '30 '40 '50
Laborers, Except Farm
Others Showed No Consistent Trend
6.6
6.6
7.4
7.3
8.7
1910 '20 '30 '40 '50
Proprietors, Managers and Officials
11.6
13.0
12.8
12.0
14.1
1910 '20 '30 '40 '50
Skilled Workers and Foremen
9.6
7.8
9.8
11.7
10.5
1910 '20 '30 '40 '50
Service Workers
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
Source: U.S. Bureau of the Census

The fastest growing group during the first half of this century was made up of clerical and sales workers. The number of clerical workers (excluding sales) rose from about 2 million—5 percent of all workers—in 1910 to over 7 million—12 percent of all workers—in 1950. The number of sales workers also increased during this period but the growth was much slower than for clerical workers.

Professional, technical, and kindred occupations were second only to clerical occupations in rate of growth between 1910 and 1950. Within this broad group, engineering, the sciences, and other relatively new professions grew faster than the traditional learned fields—the ministry, the law, medicine, and teaching. In recent years, the number of technicians who assist engineers and scientists has also increased very rapidly.

Semiskilled workers are the third occupational group which showed steady growth between 1910 and 1950, an increase from 15 percent to 20 percent of the work force over the 40-year period. Typical occupations in this broad group are machine operators or tenders, assembly workers, and truckdrivers.

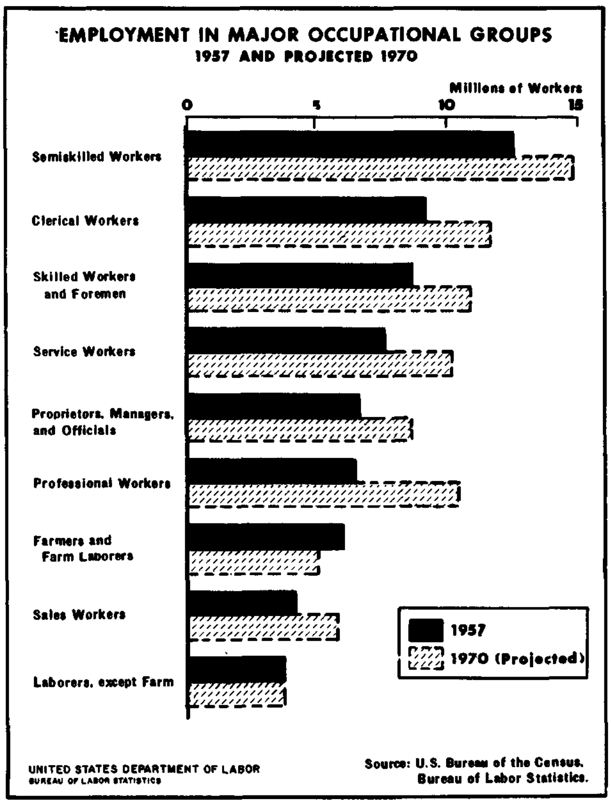
While employment was increasing in some occupational groups, it was decreasing in others. For example, farmers and farm workers have declined dramatically as a proportion of the work force—from 30.9 percent in 1910 to 12 percent in 1950. Another result of our developing technology has been the decline in the proportion of the work force in unskilled jobs—from 12 percent to only 6.6 percent.

In the other three broad occupational categories—the proprietor-manager, skilled worker, and service worker groups—trends have varied from decade to decade. One reason for the varying trends in the proprietor-manager group is that, within this broad group, there has been both a decline in the number of proprietors of small businesses and a rise in the number of salaried employees in managerial positions. Skilled workers lost ground relative to the labor force as a whole in some decades and gained in others, but over the entire 40-year period from 1910 to 1950, they moved ahead from 11.6 percent to 14.1 percent of the labor force. Service workers, the one remaining group, include employees in private households, and also such workers as waiters and cooks in restaurants, elevator operators, guards, and policemen. This group rose slightly as a proportion of the labor force between 1910 and 1950—from 9.6 to 10.5 percent.

The data on occupational trends presented so far not only relate to the past but also measure the changing size of each occupational group in relative terms as a percentage of the country's work force. In contrast, chart 8 shows the actual numbers of workers employed in 1957 in the various kinds of occupations. This chart also shows projections of employment in 1970 for each major group. In developing these projects, account was taken of the past trends outlined in preceding paragraphs and also of such factors as the expected increase in the labor force, its age and sex distribution, and the expected changes in the industrial distribution of employment and in technology.

Semiskilled workers, numbering more than 12.5 million in 1957, are currently the largest occupational group. Indications are that employment in this occupational group will have a slower rate of growth over the long run than will the labor force as a whole, since technological advances are

CHART 8



expected to permit great gains in production without corresponding increases in the number of semiskilled workers.

Employment in the clerical worker group—the second largest occupational group in 1957—is expected to continue to grow somewhat faster than the labor force as a whole during the 1960's. However, more widespread use of electronic equipment which can perform numerous clerical operations with lightning speed will undoubtedly restrict the growth in employment of office workers in the long run.

Employment of skilled workers and foremen increased at about the same rate as the total labor force during the 1950's, reaching a total of 8.7 million in 1957. With the anticipated rise in construction worker employment and the growing need for skilled maintenance men and repairmen who can install and care for increasingly complicated machinery and equipment, skilled workers are likely to increase at a slightly faster rate than the entire labor force during the 1960's.

Among service workers, employment reached a total of 7.6 million workers in 1957. It is expected to increase faster than the entire labor force up to 1970, with rising income levels and growing population.

Professional, technical, and related workers have been, since 1950, the fastest growing of all the occupational groups, moving ahead even of clerical workers. Employment in the professional-technical group, which reached 6.5 million in 1957, is expected to continue its spectacular growth in the 1960 decade. The managerial and sales groups will also have substantial employment increases in the 1960's.

Laborers and farm workers are the only occupational groups not expected to show growth in the years ahead. The number of laborers is not likely to change much from the 3.7 million employed in 1957. Employment of farm workers is expected to continue its long-term decline.

In summary, the major occupational changes expected in the 1960 decade are: (1) a continuing rapid growth in white-collar occupations, especially in the professions; (2) among blue-collar workers, a slower growth in skilled and semiskilled occupations and little if any change in employment in unskilled occupations; a faster-than-average growth among service workers; and a further decline in employment among farmers and farm laborers. Later sections of this Handbook will present in detail the outlook in the principal occupations within each major group.

Earnings from Work

Earnings from work account for more than 70 percent of our national income. They include the wages of unskilled laborers, the salaries of corporation presidents and public school teachers, the earnings of movie actors and automobile salesmen. They include pay for work in factories—for example, on clothes or electric devices—and for services ranging from haircuts to legal advice.

The mere mention of these different kinds of work reminds us that there are wide variations in the earnings of people in different kinds of jobs. In the choice of an occupation, one of the most important considerations is the earnings an individual may look forward to receiving from the various kinds of work suited to his abilities, interests, and training. This chapter is designed to suggest the range of earnings that young people entering the labor force can expect to receive in the immediate future in different occupations. It also discusses the differences among occupations with regard to earnings over a long period of time, which also have a bearing on career decisions.

In considering money earnings, it is important to remember that there are other factors that need to be taken into account in weighing the relative advantages of various jobs—including hours of work, vacations, physical working conditions, and the personal satisfactions associated with a particular type of work. Sometimes a person may regard these factors as even more important than the amount of money income he is likely to receive. For example, he may decide on a college teaching career because he places a high value on the opportunity to work with young people or to do independent research, although other jobs open to him may offer greater money income. Or a person may prefer an office job in a comfortable air-conditioned building to working with his hands in a blue-collar job offering higher earnings. The desire to be one's own boss or to work at one's own place undoubtedly induces many people to open a small business, though many proprietors of such businesses could make more money if they were willing to work for others.

Rates of Pay, Earnings, and Benefits

Rates of Pay. A person who wants to find out about the money earnings in an occupation needs, first, to get information on the basic rate of pay. This pay rate may be related either to the length of time worked or to output—the two general ways of determining wages.

Workers who are paid on a time basis typically have an hourly wage rate if they are in manual jobs. Office, supervisory, and professional workers usually have weekly, monthly, or yearly salaries. For example, a machinist in a metalworking plant in Chicago may be paid $2.50 an hour; an experienced accounting clerk in a Chicago office may receive a salary of $90 a week.

Wage rates based on amount of output are sometimes referred to as "incentive rates," since workers paid on this basis can increase their earnings by increasing their production. A worker in a machine shop, for example, may receive 5 cents for each metal part he machines; a filling station attendant may be paid $1 for every car he washes; a television salesman may get a commission based on the value of the sets he sells.

In comparing the money earnings to be expected from a particular type of incentive work with those from a job paid on a time basis, the best type of information to use is the expected "earned rate." This rate is computed by dividing earnings during a specified period (excluding any premium pay for overtime or holiday work) by the number of hours worked during that period. Thus, if the filling station employee washes 60 cars for $1 a car during a 40-hour week, thereby earning $60, his hourly earned rate will be $1.50. It is also important to know whether the incentive rates are combined with a minimum earnings guarantee, as they sometimes are, especially during new workers' first few weeks or months of employment when they are learning the job.

Annual and Lifetime Earnings. A high wage rate per hour or week does not necessarily mean correspondingly high annual earnings. The relatively high hourly or daily rates for some types of manual employment, such as building construction or longshoring, are offset in considerable measure by the lack of full-time employment. Some industries, such as clothing manufacture, offer more work in some months of the year than in others. Earnings of independent professional workers, such as doctors and lawyers, clearly are affected by the size of their practice. The wide range of earnings among members of these professions reflects not only differences in fees but, perhaps more important, differences in the numbers and types of cases handled.

Some people may prefer an occupation offering a high rate of pay with intermittent employment to one providing a smaller pay check that comes in regularly every week, but the choice should be deliberate. On the whole, office, administrative, and professional employees tend to have greater job security than those paid on an hourly basis. However, many plant workers also have a good deal of job security. This is especially true of skilled maintenance employees, such as electricians, whose services are likely to be needed even when output drops. In addition, the seniority provisions of union agreements, which govern the order in which employees are laid off and rehired when reductions in employment are necessary, provide some security to workers who have had some years of service with a firm.

Aside from immediate earnings prospects, a new worker will want to consider the longrun possibility of increased earnings, either by promotion to more highly skilled work or because of other increases in his earnings capacity, such as increased speed in turning out work. In considering earnings prospects, a worker will obviously want to consider chances for advancement. The absolute dead-end job is rare; even the most routine work, if it is well done, can pave the way to a better job. A machine operator may advance to a job as a foreman. A salesman should know his possibilities of expanding sales as he becomes more experienced and of promotion to a position such as sales manager. In some cases, on-the-job training, which may lead to higher earnings, is provided; in others, the employee may have to exercise initiative to take courses at local schools or colleges.

In general, fields requiring a good education tend to offer better earnings prospects. A college instructor who is reasonably competent can look forward to obtaining full professor's rank and may obtain an administrative post such as that of dean. The college graduate in business has many avenues open to him (in production, marketing, and finance, for example). Many large business firms promote from within and thus provide opportunities for their employees to move up the job ladder. Many gasoline service stations, television repair shops, or small hotels have been opened by individuals who began as employees, although to open even a small business the problem of obtaining capital must be solved.

In some situations it is almost essential to think in terms of opportunities for advancement and lifetime earnings. In some occupations the wage rate may be comparatively high but the job may require either more than average physical stamina or may be one in which outstanding prowess is lost at a relatively early age. In these cases, the choice is between high pay rates for a short period and lower rates which, over a lifetime, may well provide greater earnings. A job decision might involve a choice between professional baseball, with the chance (though not the certainty) of high earnings for a few years, and a career in electrical engineering, with reasonable assurance of steady and growing earnings over the long pull. Another example is the choice for a young lawyer between salaried employment with a government agency and independent practice with a chance of attaining the very high incomes received by the few at the top of the legal profession.

Of course, millions of people will remain, for their entire working life, within the general white-collar or manual job category in which they start. Coal miners will tend to remain miners; business machine operators will tend to remain in this general field; most factory operatives form a permanent attachment to some particular type of work. In these cases, only limited increases in earnings can be anticipated from job transfers; higher earnings will result partly from the fact that many time-rated jobs provide for a limited number of periodic increases in pay above the entrance rate, but primarily from the general rise in productivity in the economic system.

Premium Pay and Supplementary Benefits. Up to now the discussion has dealt with base wage or salary rates and money earnings. Under certain conditions, however, premium pay may increase money income. Premium pay for work beyond both daily or weekly normal hours is now widespread and union-management agreements typically call for premiums for weekend or holiday work as well as for work on late shifts. In choosing a job, therefore, a worker should realize that jobs vary considerably in chances for overtime or nightwork and should weigh the opportunities for extra pay against the offsetting loss of leisure time.

Most jobs typically yield a variety of benefits that represent sources of leisure and long-term income. Since these benefits vary from industry to industry and very often among firms in the same industry as well as from one part of the country to another, they should be considered in making job decisions. One important type of benefit involves payment for time not worked, such as for vacations, holidays, and sick leave. Another important group of benefits includes pensions and health and insurance plans, which have grown rapidly during the past decade. Private pension plans supplement retirement benefits to which most workers are entitled under the Federal Old-Age, Survivors and Disability Insurance system. Health and insurance plans frequently include life, accidental death, and dismemberment insurance as well as sickness, hospitalization, surgical, and medical care benefits. Supplementary unemployment benefits financed from private funds set up by employers have recently been added to State unemployment compensation benefits in such major industries as automobiles, steel, and rubber. These supplemental unemployment benefits can contribute greatly to stabilizing income where employment fluctuates from season to season or with the business cycle.

Current Pay Levels

The preceding section has outlined the various factors that enter into the worker's total lifetime earnings and the choices he must make—e.g., between the prospect of higher pay per hour on the one hand, and more hours of work on the other, or between the alternatives of high pay for a few years and modest but gradually increasing pay rates over a longer span of years. The remaining pages discuss in somewhat more detail the extent to which hourly or weekly earnings vary among jobs, areas, and industries, and try to give a picture of pay levels in the American economy, which may be helpful as background in judging earnings prospects in a specific occupation. Obviously, in evaluating a given rate of pay, say $1.50 an hour, it is helpful to know whether most other workers are earning more or less than this amount.

In 1957, annual wage and salary income of full-time workers averaged about $4,200 (table 1). Average earnings were about $4,700 for men and approximately $3,000 for women. These income figures exclude self-employed workers (including many professional workers such as doctors and lawyers), but include business executives. At the lower end of the distribution (2.5 percent of the workers received less than $500 in annual wage and salary income) are many workers such as farmers who receive some wages but who depend

TABLE 1. *Percentage distribution of workers[1] by wage or salary income, 1957*

Wage or salary income	Men and women	Men	Women
$1–$999	5. 0	4. 6	6. 5
$1,000–$1,999	6. 6	3. 9	14. 4
$2,000–$2,999	14. 5	9. 3	28. 8
$3,000–$3,999	20. 1	16. 1	31. 0
$4,000–$4,999	19. 6	21. 9	12. 9
$5,000–$5,999	15. 2	19. 1	4. 3
$6,000–$6,999	8. 2	10. 8	1. 1
$7,000–$9,999	7. 8	10. 3	. 8
$10,000–$14,999	2. 4	3. 2	. 2
$15,000–$24,999	. 5	. 7	. 1
$25,000 and over	. 2	. 3	--------
Total	100. 0	100. 0	100. 0
Average[2]	$4, 175	$4, 713	$3, 008

[1] Wage or salary income of year-round full-time workers, 14 years of age and over.

[2] Median—i.e., half the workers earned less than this figure and half earned more.

SOURCE: U.S. Bureau of the Census.

primarily on other sources of income (for example, the sale of farm products).

Most workers in American industry are employed in nonsupervisory manual and office positions. As of late 1958, the great bulk of these nonsupervisory and office workers earned between $1 and $3 an hour or between $2,100 and $6,250 a year, assuming a workweek of 40 hours and 52 weeks' pay a year. Probably between 40 and 50 percent of these workers earned $2 or more an hour.

Workers covered by the Federal Fair Labor Standards Act must be paid at least $1 an hour. This minimum covers practically all workers in manufacturing, mining, wholesale trade, and transportation, but does not apply to most workers in retail trade and service industries or to farm labor. In these latter industries, an appreciable number of workers are paid less than $1 an hour. (As table 2 shows, about one out of four retail trade employees received less than $1 an hour in 1956.)

In other words, in most industries workers can expect to receive starting wages of at least $1 an hour, but there are exceptions in which lower rates will be paid. Of course, the actual minimum in many firms, industries, and areas exceeds the legal requirements—in many cases, by a substantial amount. At the upper end of the wage structure, a comparatively small proportion of the nonsupervisory manual and clerical workers earn $3 an hour or more. In 1958, about 1 out of 16 "blue-collar" workers in manufacturing earned at least $3 an hour.

The variations in pay shown in table 2 reflect differences among occupations, industries, and areas, and among establishments within the same area. The pay rates of one job relative to another depend primarily on the demand for and number of workers available with the supply largely depending upon the skill, training, and other requirements of the jobs. In discussing the variation in pay among jobs, it is helpful to think in terms of a few broad job groups. In the case of unskilled workers, the requirements are comparatively simple and involve little training, skill, or capacity to make decisions. Next are the very large numbers of semiskilled jobs that are essentially routine but that may involve, for example, the operation of special types of machines or other equipment, the performance of various recordkeeping functions, or the exercise of limited amounts of judgment. The next level of jobs may involve all-round skill in a particular craft, responsibility for the operation of highly complex equipment, and capacity for decisionmaking within a defined area of responsibility.

These three classes of workers—skilled, semiskilled, and unskilled—together contain the literally thousands of manual and office jobs below the supervisory level. The three groups are by no means clear cut—one tends to shade into an-

TABLE 2. *Percentage distribution of production or nonsupervisory workers in selected industries by straight-time average hourly earnings,[1] selected dates*

Average hourly earnings	Manufacturing, 1958	Textiles, 1958	Motor vehicles, 1957	Retail trade, 1956
Under $1.00	0. 3	0. 2	Under $2.00, 0.1.	26. 4
$1.00 and under $1.20	12. 9	26. 9		21. 5
$1.20 and under $1.40	9. 8	30. 3		14. 2
$1.40 and under $1.60	8. 9	19. 0		10. 4
$1.60 and under $1.80	9. 8	12. 8		7. 6
$1.80 and under $2.00	10. 2	4. 6		5. 1
$2.00 and under $2.20	11. 8	2. 7	13.3	5. 3
$2.20 and under $2.40	11. 7	1. 4	63.1	3. 1
$2.40 and under $2.60	8. 5	. 9	9.4	2. 3
$2.60 and under $2.80	6. 1	. 5	5.0	1. 3
$2.80 and under $3.00	4. 2	. 2	6.6	. 8
$3.00 and over	5. 7	. 5	2.8	2. 2
Average hourly earnings	$1. 97	$1. 42	$2. 37	$1. 41
Number of workers (in thousands)	11, 245	831	491	6, 033

[1] Excludes premium pay for overtime, weekend, and holiday work, and for work on late shifts.

other and earnings overlap. For example, factors such as incentive pay may raise earnings of some semiskilled workers above those of some skilled jobs and rates for the same jobs vary from area to area, industry to industry, and plant to plant. This overlap is illustrated for one area—Baltimore—in the chart on page 31. While laborers in Baltimore averaged $1.05 an hour less than machinists, the highest paid laborers earned more than the lowest paid machinists.

There has been a longrun tendency for pay differences among jobs to decline. During the past few years, the tendency for pay differentials between skilled and unskilled workers to narrow has been arrested but not reversed, and it seems probable that increasing attention will be given in the future to the question of pay differences among jobs. In 1957–58 in a group of about 20 major labor markets, hourly earnings for a number of skilled jobs were about 50 to 70 percent above the unskilled rate (represented by pay of janitors). Today, most skilled blue-collar workers probably earn $2.50 or more an hour. It is they who, together with some of the men office clerical workers and some salesmen, comprise the group of workers whose pay exceeds $3 an hour.

There has also been a significant change in the pay position of office employees compared with manual workers. At one time officeworkers, even in the most routine jobs, received not only higher pay but more liberal benefits than unskilled plant workers; these differences have narrowed greatly in recent years.

The information in table 2 largely excludes officeworkers. Tables 3 and 4 present data on pay of women officeworkers in 17 large communities. Table 3 presents a picture of salary rates that girls just entering the labor market in white-collar jobs can expect to earn in a group of major communities. This table indicates that in these cities starting rates averaged from $42 to $57 a week for inexperienced typists in 1957–58. Comparison of this table with table 4 gives some notion of the opportunities for increasing pay with advancement to more responsible office clerical jobs; the latter table shows earnings for ex-

TABLE 3. *Weekly entrance salaries for women hired as typists and for other entrance clerical positions in selected major labor markets, winter 1957–58*

Area	Inexperienced typists		Other inexperienced clerical workers	
	Average salary [1]	Middle [2] range of salaries	Average salary [1]	Middle [2] range of salaries
Northeast:				
Boston	$45. 50	$42. 50–48. 50	$44. 50	$41. 50–47. 00
Newark	50. 50	46. 50–56. 00	49. 50	45. 00–54. 50
New York	51. 50	48. 50–55. 50	49. 50	46. 00–52. 50
Philadelphia	47. 00	43. 00–51. 50	46. 00	41. 50–50. 50
South:				
Atlanta	44. 50	41. 50–49. 00	43. 50	41. 50–48. 50
Baltimore	46. 50	42. 50–53. 50	44. 50	41. 50–49. 50
Memphis	42. 00	41. 00–47. 50	42. 00	41. 00–47. 00
New Orleans	43. 00	41. 00–47. 50	42. 00	40. 50–47. 50
North Central:				
Chicago	54. 50	51. 00–59. 50	52. 50	49. 50–57. 50
Cleveland	54. 00	50. 50–59. 50	53. 00	47. 00–59. 00
Milwaukee	49. 50	45. 50–52. 50	47. 00	43. 00–52. 00
Minneapolis–St. Paul	44. 50	42. 00–48. 50	43. 50	41. 50–47. 00
St. Louis	48. 00	44. 00–54. 50	47. 00	42. 00–53. 00
West:				
Denver	48. 50	44. 50–52. 00	47. 00	44. 00–52. 00
Los Angeles–Long Beach	57. 00	52. 00–64. 00	55. 50	50. 50–62. 00
Portland	52. 00	45. 50–60. 50	51. 50	45. 50–59. 50
San Francisco–Oakland	57. 00	51. 50–63. 00	56. 00	51. 00–62. 00

[1] Median—i.e., half the establishments studied paid less than this rate and half paid more.
[2] A fourth of the establishments studied paid less than the lower rate of the range and a fourth paid more than the higher rate.

Table 4. *Weekly salaries for women secretaries and stenographers in selected major labor markets, winter 1957–58*

Region and Area	Secretaries		Stenographers, general	
	Average salary	Middle range [1] of salaries	Average salary	Middle range [1] of salaries
Northeast:				
Boston	$71.50	$62.00–80.00	$61.50	$54.50–69.00
Newark	83.00	74.50–90.00	67.50	60.50–75.00
New York	85.00	75.00–94.00	69.00	62.00–76.50
Philadelphia	78.00	67.50–86.50	64.50	56.00–72.00
South:				
Atlanta	77.50	65.50–88.00	65.50	56.50–72.00
Baltimore	76.00	66.00–85.50	64.00	54.00–74.00
Memphis	66.00	56.00–75.50	58.50	49.00–65.00
New Orleans	76.50	66.00–87.00	62.00	54.00–68.00
North Central:				
Chicago	87.00	78.50–94.00	74.00	66.50–80.50
Cleveland	89.50	79.50–98.50	74.00	65.50–82.00
Milwaukee	83.50	73.50–93.00	66.50	59.00–73.50
Minneapolis–St. Paul	74.00	66.00–81.00	62.00	55.50–68.00
St. Louis	79.00	69.00–89.00	63.50	56.50–69.50
West:				
Denver	79.00	70.50–87.50	66.50	61.00–73.00
Los Angeles–Long Beach	87.00	80.00–93.50	75.00	68.50–81.50
Portland	80.50	71.00–88.00	69.00	62.00–77.00
San Francisco–Oakland	85.00	76.00–93.00	74.00	66.50–79.50

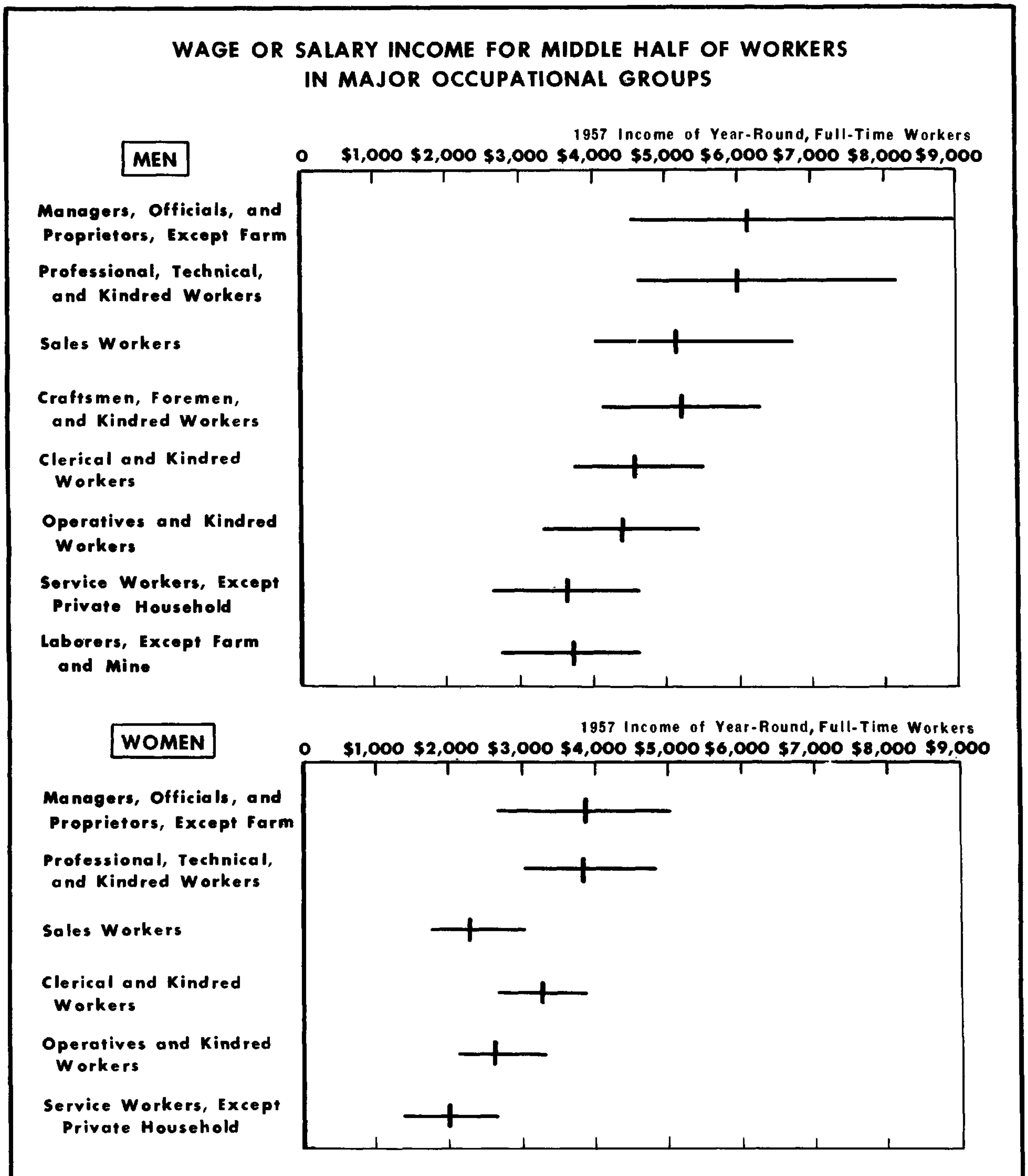
[1] A fourth of the workers received less than the lower salary shown and a fourth received more than the higher salary.

perienced general stenographers and secretaries in the same communities. Average salaries of secretaries are typically about $25 to $35 a week higher than the average starting rate for inexperienced typists in the same communities.

The pay of professional and executive employees tends to stand above the rate structure for workers in nonsupervisory positions, though there is a considerable overlap between the pay structures for the two groups. This is particularly true with respect to a number of professions in which large numbers of workers are employed on a salaried basis and in which a large number of women are employed. For example, a survey by the U.S. Office of Education indicates that in the 1956–57 academic year, the average salary for beginning public school teachers was $3,600. The average maximum salary for teaching in a group of large cities surveyed by the American Federation of Teachers reached over a period of years was $6,100 for those with a bachelor's degree and $6,400 for those with a master's degree. Maximum salaries for those with master's degrees ranged to more than $8,500 in some New York City suburbs. As pointed out earlier, annual pay for most wage earners who work full time is probably between $2,100 and $6,300. Librarians, dietitians, and registered nurses are examples of other professional groups with average earnings that overlap those of the higher paid manual and office workers. The average rate for senior draftsmen, a technical occupation, approximates the average for tool and die makers, a top-skilled manual job.

Most salaried professional workers probably fall in a range from about $5,000 to $15,000 depending on their occupation, age, education, ability, and a variety of other factors such as geographic location. Some earn substantially more than the upper limit of this range and, of course, some earn less than the lower limit. The range of earnings among self-employed professional workers—doctors, dentists, and lawyers, for example—is much greater than among salaried employees in these fields, and the upper end of the range is generally higher. Independent practice of a profession contains an element of risk. There are relatively few high rewards and there are failures. The odds against success vary among fields; for example, there is a greater risk of failure among professional entertainers than among physicians and there are corresponding

CHART 9



Note: The mark on each bar indicates the median (average) income of the workers in the given occupational group: Half made more and half less than this amount.

The length of the bar shows the income range of the middle half of the workers in the occupational group. One-fourth earned less than the amount indicated by the left end of the bar, and one-fourth earned more than the amount indicated by the right end.

UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Source: U.S. Bureau of the Census

variations in the top incomes. In professions like medicine, an individual has a very good chance of achieving a substantial income if he has reasonable competence and capacity to work. In 1951, according to the Bureau of the Census, half the self-employed physicians and surgeons earned more than $10,000.

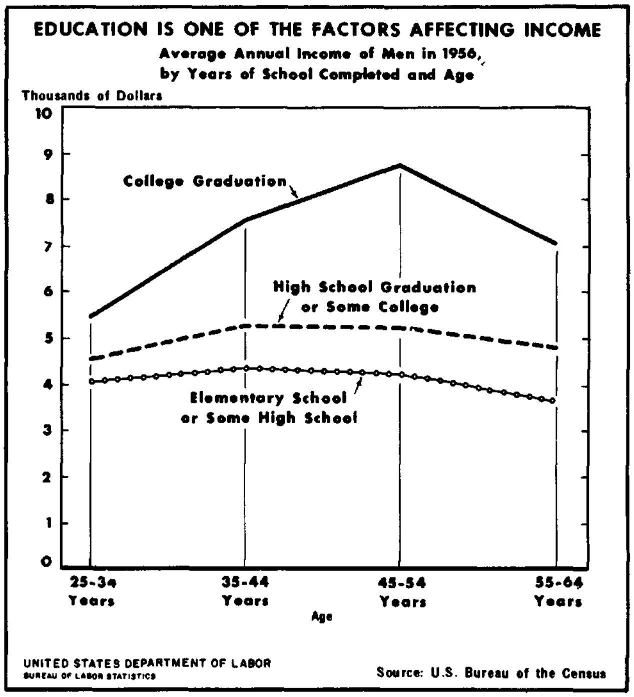
Frequently, professional and supervisory functions are combined and the higher pay levels for professional workers on a salaried basis reflect their supervisory duties.

Rates of workers in supervisory and executive jobs vary enormously because of great differences in duties and responsibilities. A foreman may be responsible for the work of half a dozen men and his pay may be closely related to the wages of those he supervises—perhaps 10 percent higher. The president or manager of a company may be paid at least 10 or 20 times as much as most of his employees.

Variations in average annual wage or salary income in 1957 for eight broad occupational groups are summarized in chart 9. As would be expected, the highest incomes are received by managers, officials, and proprietors, with professional and technical workers coming next. Lowest paid were service workers and laborers. Salesmen earned slightly less on the average than did craftsmen and foremen.

More or less closely related to differences in pay among broad occupational groups are differences in pay with variations in educational background. The increase in earnings opportunities that comes with increased education is indicated by chart 10. High school and college graduates earn more than those with only 8 years of schooling in their early working years. Moreover, as college graduates grow older, earnings increase much more rapidly than do earnings of those with less education. In 1956, men college graduates aged 45 to 54 earned more than twice as much as elementary school graduates and 70 percent more than high school graduates.

CHART 10

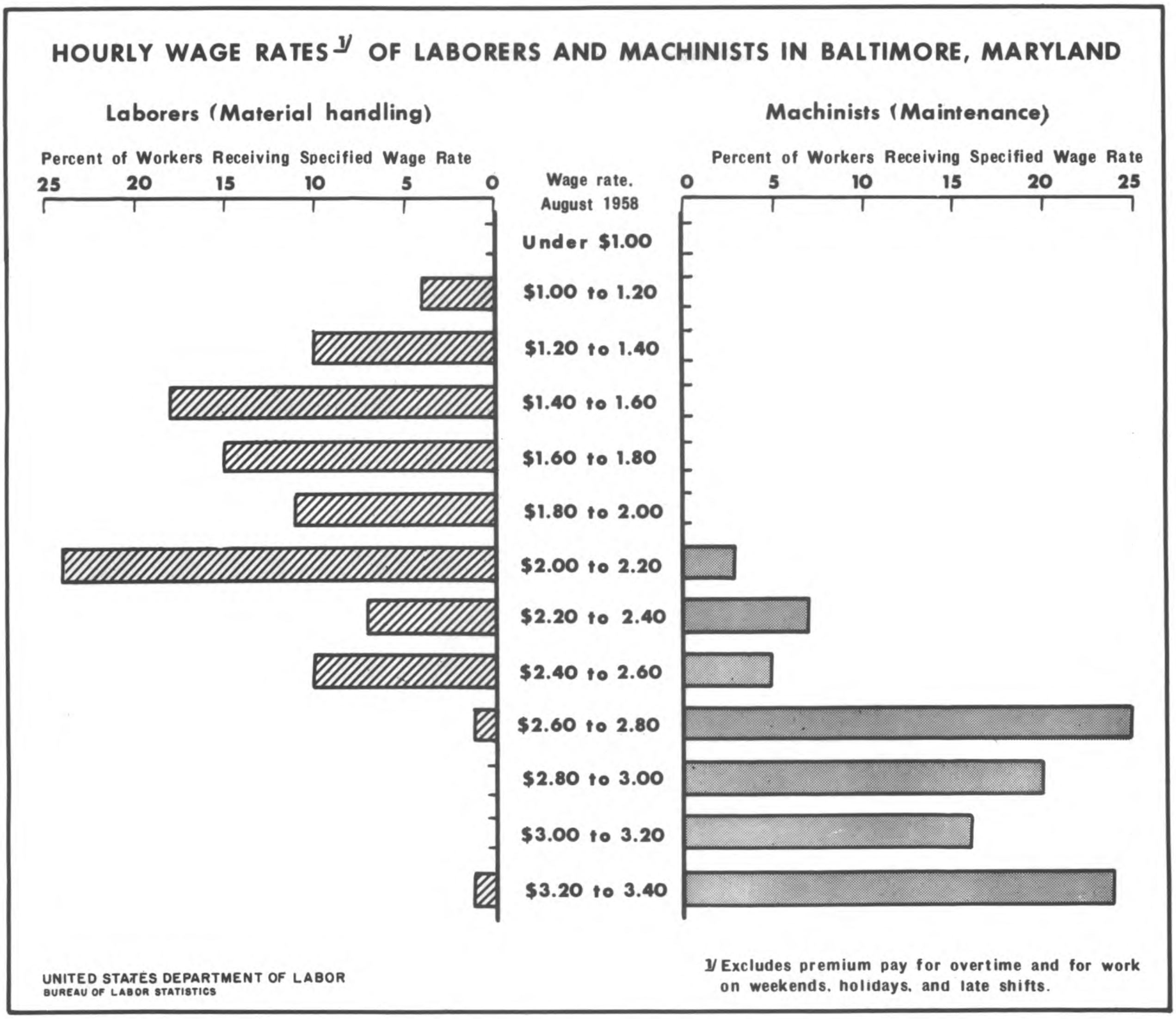


Variation in Pay Within Occupations. While the occupation in which a worker is employed greatly affects his earnings, it should be emphasized that there are wide variations in pay within an occupation.

Pay differs substantially not only among regions of the country but among cities within the same region. In general, pay tends to be higher in large than in small communities but it also varies among large cities. These interarea differences tend to be proportionately greater for unskilled than for skilled and white-collar occupations. In the main, the highest wage scales are found on the West Coast and the lowest in the South, although pay levels for skilled workers and white-collar workers in New England are often close to those in the South. An illustration of the variation in pay among communities is provided by the average earnings of machinists in 1957–58. Workers in this occupation averaged $2.44 an hour in Boston, $2.45 in Atlanta, $2.86 in the San Francisco Bay area, and as high as $2.89 in Chicago. As table 3 indicates, entrance rates for inexperienced typists varied in 1957–58 from an average of less than $45 a week in such communities as Atlanta, Memphis, New Orleans, and Minneapolis–St. Paul to more than $55 in Los Angeles and San Francisco. It should be borne in mind that these intercity differentials in pay tend to be proportionately greater than differentials in living costs, although these two differentials are not closely related.

It is not surprising that there is typically a range of rates for the same job in the same labor

CHART 11



market, rather than a single rate. People doing the same type of work vary in their productive capacity; so differences in rates reflect, to some extent, variations among individuals. Many firms recognize this fact by establishing a range of rates for each job, with progression within the range depending on merit, length of service, or both. Rates also vary among firms in the same area. Thus, table 3 shows substantial differences in hourly rates for inexperienced officeworkers. In New York City, one out of four offices hired inexperienced typists in 1958 for less than $45.50 a week while another one out of every four hired them at more than $55.50. In Baltimore, hourly rates of laborers varied from less than $1 to $3.30 or more, and maintenance machinists, from $1.80 to more than $3.30 in August 1958 (chart 11). Sometimes differences in pay among firms reflect variations in the duties and conditions attached to the job. For example, rates paid laborers hired to load and unload materials may vary depending on the weight of the materials being handled or on whether the job is performed indoors or outdoors. Earnings also tend to be somewhat higher for incentive workers within an occupation than they are for time workers.

Variations Among Industries. Part of the difference in pay for the same occupation just discussed is traceable to differences in pay for the same job among industries. Turning to differences in average earnings among industries, much of this variation reflects differences in the occupational pattern among these industries. For example, a tool and die shop employs a much higher proportion of highly skilled workers than does a cigarette factory. These differences in occupational structure among industries, of course, reflect differences in opportunities for promotion for workers with the requisite training. In general, earnings tend to be highest in such manufacturing industries as petroleum refining, printing, and basic steel; and in such nonmanufacturing industries as electric and gas utilities. Table 2 illustrates differences in earnings among industries, showing data for one manufacturing industry with relatively high earnings and one with relatively low average pay. Only 1 out of 1,000 workers in the automobile industry earned less than $2 an hour in 1957 contrasted with more than 900 out of 1,000 in the textile industries.

Professional, Administrative, and Related Occupations

Professional and administrative occupations have many attractions for young people considering the choice of a career. These occupations offer opportunities for interesting and responsible work, lead to relatively high earnings, and are at the top of the ladder in prestige. However, they can, as a rule, be entered only after long periods of education and training, since a broad knowledge of one's field and judgment of a high order are outstanding requirements for success in these types of work.

More than one-fifth of all workers in 1958 were in professional, administrative, and related occupations. These occupations—employing nearly 14 million people—accounted for about half of all white-collar employment.

Professional and Related Occupations

Professional occupations are of two main types. The largest group of professions—including those of engineer, architect, physician, lawyer, and teacher—requires formal education in well-organized fields of knowledge. The other group—including occupations such as editor and actor—does not require as much specialized, theoretical knowledge, but demands a great deal of broad background knowledge or creative talent, and skill acquired chiefly through experience. Generally, the professions require either college graduation—often with an advanced degree—or experience of such kind and amount as to provide a comparable background. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example—with licensing authorities determining the minimum qualifications which members must have. Professional societies also set up membership standards, which tend to define their respective fields. In many areas of work, however, there is no clear-cut line between professional and other classes of workers.

It is not easy to prepare for and enter professional work. For most professions, one must complete a long period of training and hard study in competition with the very brightest students. In many cases, one must pass difficult examinations in the colleges and professional schools and before State licensing boards. Often, applicants are not accepted for professional training unless their school grades are high, and employers generally give preference in hiring to graduates whose grades in professional school put them high in their class.

Closely related to the professions—and sometimes overlapping them—is a wide variety of technical occupations. People in these occupations work with engineers, scientists, physicians, and other professional personnel. Their job titles include, for example, those of draftsman, engineering aid, and electronic, laboratory, or X-ray technician. Employment as a technician requires a combination of basic scientific knowledge and manual skill, which can be obtained through about 2 years of post high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training. Many of the duties of technicians may be performed also by beginning professional workers. However, because of their more limited educational background, technicians generally find it much more difficult to advance to high-level positions than do professional workers.

The major professional, technical, and related occupations are shown in chart 12. Teaching, engineering, nursing, and accounting were, by far, the largest professional occupations in 1950. Among technicians, draftsmen were the largest group.

Employment Trends

Employment in professional, technical, and related occupations has risen during each decade since 1870—from less than half a million workers to about 5 million in 80 years. Since 1950, the rise in the number of these workers has been spectacular, reaching 7 million in 1958. (See chart

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CHART 12

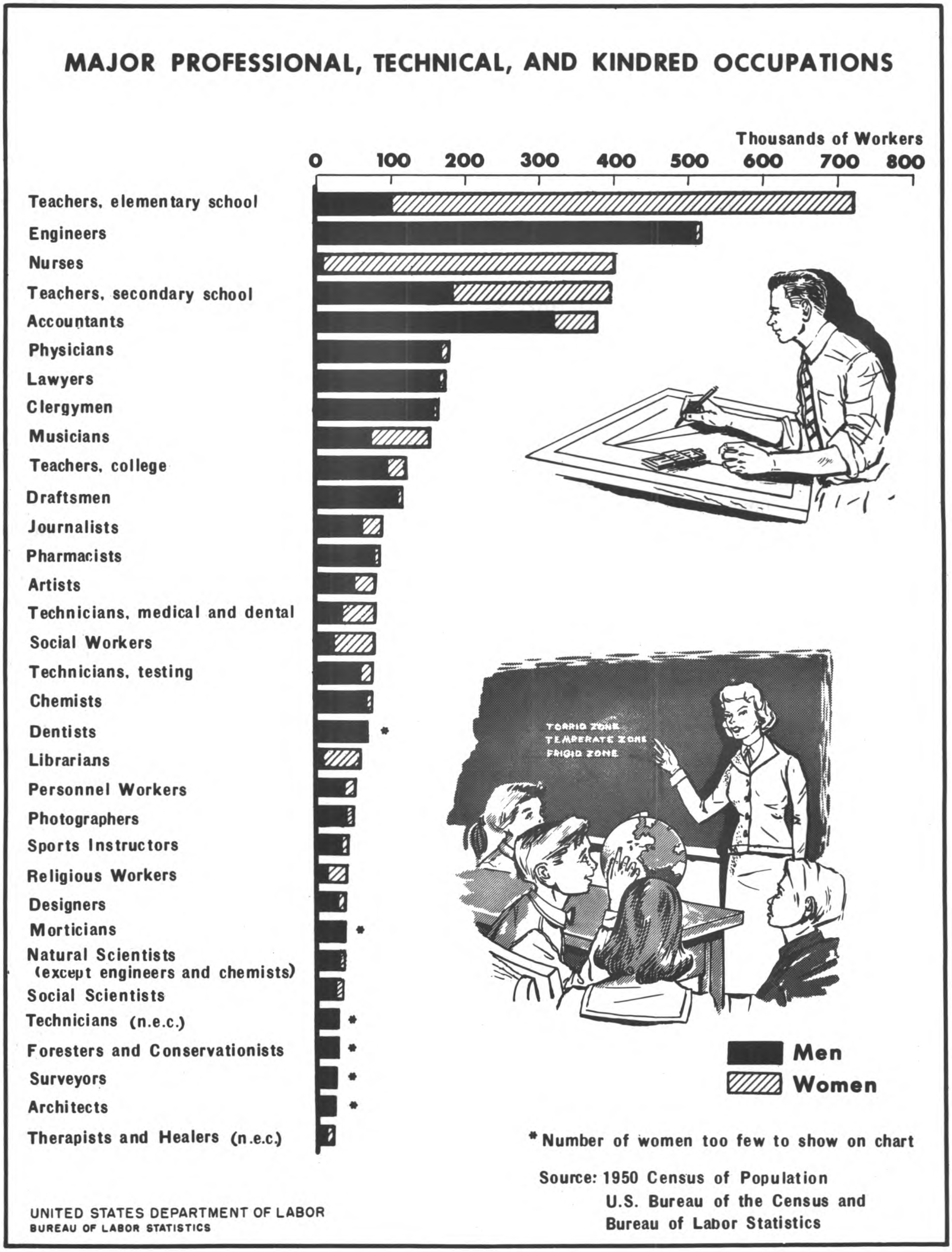
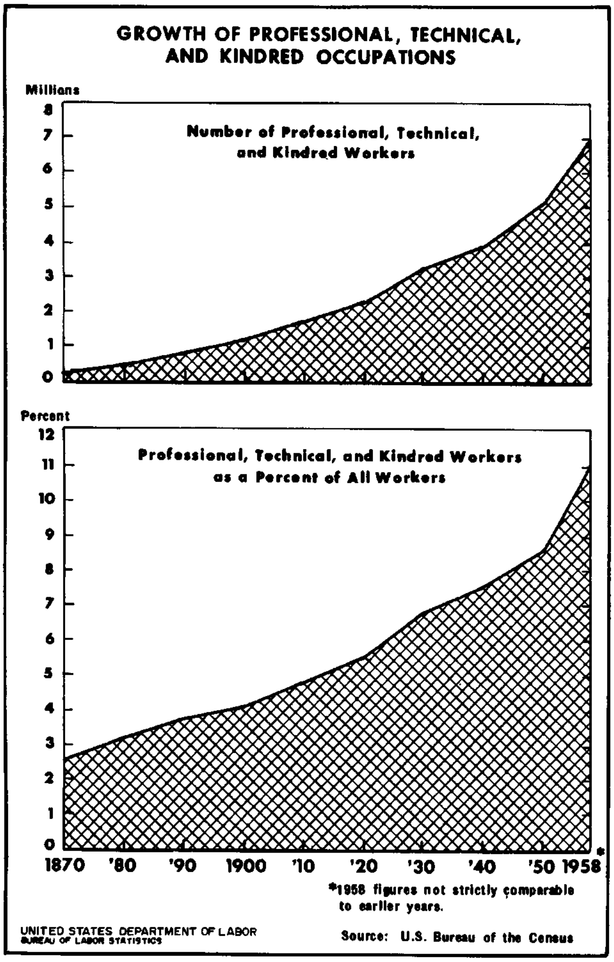

MAJOR PROFESSIONAL, TECHNICAL, AND KINDRED OCCUPATIONS
Thousands of Workers
0
100
200
300
400
500
600
700
800
Teachers, elementary school
Engineers
Nurses
Teachers, secondary school
Accountants
Physicians
Lawyers
Clergymen
Musicians
Teachers, college
Draftsmen
Journalists
Pharmacists
Artists
Technicians, medical and dental
Social Workers
Technicians, testing
Chemists
Dentists *
Librarians
Personnel Workers
Photographers
Sports Instructors
Religious Workers
Designers
Morticians *
Natural Scientists (except engineers and chemists)
Social Scientists
Technicians (n.e.c.) *
Foresters and Conservationists *
Surveyors *
Architects *
Therapists and Healers (n.e.c.)
TORRID ZONE
TEMPERATE ZONE
FRIGID ZONE
Men
Women
* Number of women too few to show on chart
Source: 1950 Census of Population
U.S. Bureau of the Census and
Bureau of Labor Statistics
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

CHART 13



13.) Even though employment in other occupations has also risen over the years, the rate of growth in the professions and closely related occupations has been much faster than for all workers taken together—for example, the professions accounted for only 4 percent of all workers in 1900, but for 8 percent in 1950, and 11 percent in 1958. Recently, the professions have become the fastest growing of all major occupational groups. Between 1953 and 1958, employment of professional workers rose 28 percent—a rate of growth twice that for clerical workers, the second fastest growing occupational group.

A major reason for the increase in the total number of workers in professional and related occupations has been the development of new professional fields. In 1870, nearly 75 out of every 100 professional workers were in medicine, the ministry, law, and teaching, compared with only about 40 out of 100 today. Although these occupations have all grown considerably since that time, their growth has been slower than that of many newer professional fields. For example, in 1950, the medical profession employed only 3 times as many people as 80 years before, the ministry and the legal profession each employed about 4 times as many, and teaching about 10 times as many. On the other hand, the number of people in scientific, engineering, and closely related professions was nearly 100 times greater in 1950 than in 1870—a growth which has both contributed to and resulted from the rapid development of science and engineering during the past century. Other major professions, not recognized as separate occupational fields in 1870, have also developed—for example, social work, accounting, and personnel work. The basic reasons for the development of new professions are the extension of scientific knowledge and the more complex organization of society and of work. The trend toward subdivision of professional fields into more and more specialties is a continuing one, and many professions are still in the early stages of development.

Along with the expansion in scientific and engineering professions, there has been rapid growth also in technical occupations. In the single decade 1940 to 1950, for example, employment of industrial technicians increased by 150 percent. As scientific and technical work has become more highly organized, particularly in the laboratories and engineering departments of large firms and in government agencies, more technical assistance has been provided for the professional workers. Similarly, large numbers of technicians and assistants work in the health fields in order to free the professional personnel for work requiring more training.

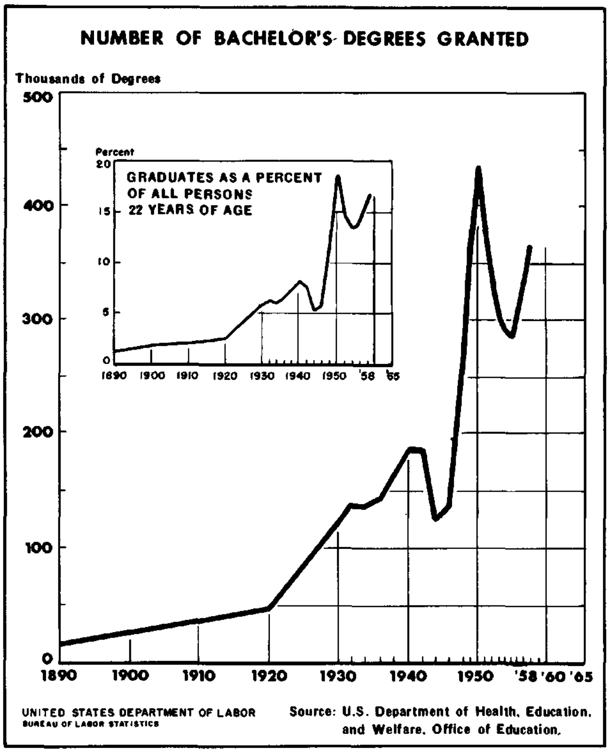
The growth of the professions has brought with it a great increase in the number of women as well as of men professional workers. In early 1959, 37 percent of all professional and related workers were women, compared with 27 percent in 1870. Women professional workers are still concentrated in a few fields—above all, teaching and nursing. However, in fields such as engineering and the sciences, where there have been personnel shortages in recent years, women have been finding increasingly favorable employment opportunities.

Since the reasons for the growth of the professions are deeply rooted in our dynamic economy and technology, there is every reason to look forward to continued expansion in professional employment in future years. However, there will naturally continue to be differences in the rate of growth among professions, as is indicated in the statements on most of the major professions in following chapters.

Educational Trends

The growth of the professions has been accompanied by a great increase in the numbers of young men and women graduating from college—who are, of course, the chief source of professionally trained workers. The proportion of young people completing college rose from 2½ percent in 1920 to 8 percent in 1940 and to 16 percent in 1958, as shown in the inset in chart 14. (The high level reached in 1950, is artificial, reflecting the large number of veterans who went to college under the veterans' education program and who, in many cases, would have completed college earlier if it had not been for the war.)

CHART 14



The recent rapid increase in the proportion of young people graduating from college reflects a number of basic social trends. Family incomes are higher, and more people can afford to put off going to work and to pay the costs of education. More families want a college education for their children. Scholarships and loans are available for more students; part-time work opportunities are also available, particularly in times of labor shortages. Finally, a college education is becoming necessary for an increasing proportion of jobs. In the professions, which are continuing to grow in size and importance, a college education has largely supplanted on-the-job training as a way of preparing for professional employment. Moreover, employers are giving preference to college-educated workers for more and more administrative, sales, and other nonprofessional positions. Since these factors will probably continue to be influential in the future, the proportion of young people who graduate from college is expected to go on increasing for many years.

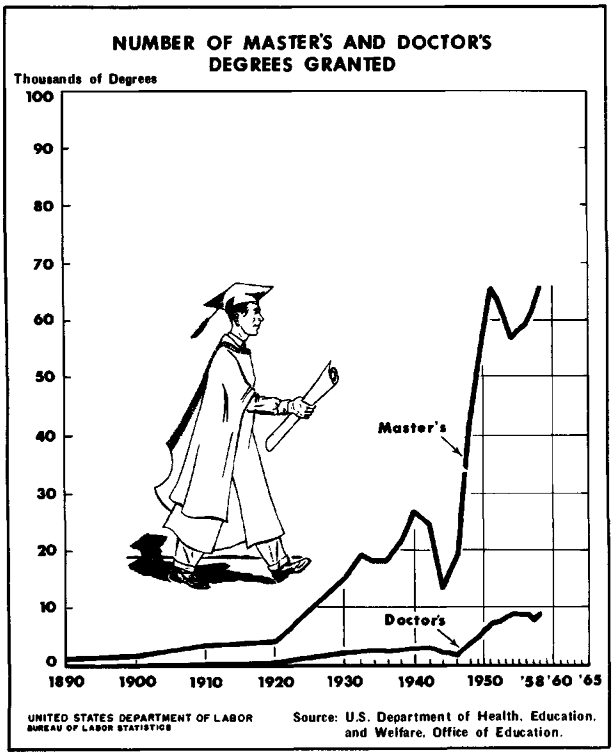
The college age population is also growing. The number of people aged 18 to 21 dropped to a low point of 8.5 million in 1953, as a result of low birth rates during the depression years of the 1930's. Thereafter, the 18- to 21-year-old population began to increase. By 1960, it will be 9.6 million, 13 percent higher than in 1953; by 1965, 12.2 million, 44 percent higher; and by 1970, 14.6 million, or 72 percent higher.

All this adds up to a great increase in college graduations, assuming that the Nation's colleges and universities can build the classrooms, laboratories, dormitories, and other facilities and hire the faculty members needed to provide for the greatly increased numbers of students. If past trends continue, it is likely that the number of bachelor's degrees awarded annually will more than double the current figure by 1970. Projections prepared by the U.S. Office of Education indicate an increase from the 365,700 bachelor's degrees granted in 1958 to 437,000 in 1960, 567,000 in 1965, and 766,000 in 1970.

The number of students taking graduate training has also risen very rapidly during past decades, and will probably continue to mount in the years ahead. Graduate education means, of course, continuing study in a university after one has received the bachelor's degree, which is usually earned at the end of 4 years of college. A master's degree is usually earned through 1 or 2 years of study beyond the bachelor's degree. To earn the Ph. D. (doctor of philosophy) degree usually requires 3 or more years beyond the bachelor's degree. As a rule, graduate study is concentrated in the major subject field of the student's interest, whereas undergraduate study is broader in content.

Chart 15 shows the tremendous increase in graduate degrees awarded since 1920 in all fields taken together. The numbers of master's and doctor's degrees granted reached unprecedented heights in the early 1950's, following the record number of bachelor's degrees granted a few years before. After a slight decline in the mid-1950's, master's degrees rose to about 65,600 in 1958 and are expected to exceed 100,000 in 1965, if past trends continue. The number of doctorates awarded in 1958 (8,950) may reach 15,000 by 1965. According to projections made by the U.S. Office of Education, the number of master's degrees conferred may exceed 160,000 and doctorates may approximate 20,000 in 1970.

CHART 15



These projections obviously imply a great increase in the supply of personnel which will be available for professional employment. Since the demand for personnel is also expected to show continued growth, there is promise of expanding employment opportunities for the increasing numbers of college graduates. The anticipated increases in college-trained personnel raise the possibility, however, of increasing competition during the 1960's for the better professional positions in at least some fields of work, as indicated in the statements on the various fields in following chapters.

Young people interested in entering a profession should consider the trend toward requiring more and more educational preparation for professional positions, which is likely to be reinforced as more college-trained workers become available. The extension of educational requirements for professional work has been due basically to the growing complexity of the various fields of science and other professions, which has lengthened the period of education and on-the-job training required for mastering the field. However, the increase in college graduations has also contributed to the trend; as more workers with graduate degrees become available, such degrees become increasingly important in competing for employment in the fields. It is believed that these trends will continue—that employers will require college education as a minimum qualification for more and more different occupations or, at least, will give preference to people with such education; also that an increasing amount of graduate education will be required by employers or State boards of licensure in some occupations for which college training is already a prerequisite.

Administrative and Related Occupations

People in administrative and managerial work run the Nation's businesses, large and small. Their positions range from that of proprietor of a small business, such as a lunch counter or corner grocery store, to that of president of a giant corporation.

Altogether, approximately 6.8 million people—including about 1 million women—were working as proprietors, managers, and officials (excluding farmers and farm managers) in 1958. About half of all persons in this field were self-employed—most often in retail stores. Salaried officials of business firms made up the second largest group. Several hundred thousand administrative workers were also in Federal, State, and local government agencies and in nonprofit organizations of many kinds. In addition, at least ½ million other workers—buyers, purchasing agents, credit men, and many others—held jobs closely related to administrative and managerial work.

Administrative and Managerial Occupations

Jobs in business management can be grouped in several broad classes. At the top are the general administrators of large companies who make plans, set broad policies, and have overall responsibility for the operation of the company or a major segment of its activities. Included in this group are such high-ranking officials as presidents, vice presidents, general managers, division superintendents, and men with similar titles.

Below the top officials are the administrative personnel—such as plant managers, comptrollers, sales managers, purchasing agents, credit managers, and buyers in stores—who direct individual departments or special phases of a firm's operations. In very large corporations, officials in charge of these functions have great responsibility and are often considered part of the top management.

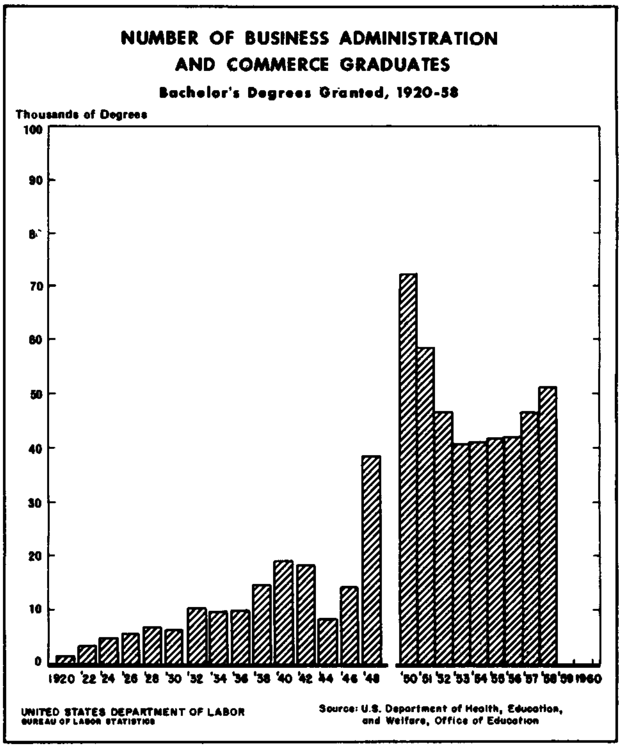
The duties and responsibilities of the managers of small firms are obviously quite different from those of officials of large corporations. In the smallest businesses, the proprietor acts as his own general manager, sales manager, buyer, and bookkeeper. He may supervise his workers directly and deal directly with customers. In some types of owner-operated businesses—for example, neighborhood bakeries, shoe repair shops, and small printing shops—knowledge of the particular trade or technical process counts as much towards success as does managerial ability.

Training for Administrative Occupations

Business administration has been known traditionally as a field in which men of outstanding ability and energy could rise without the aid of a college education. This is still true to a considerable extent, especially in small business. Each year, thousands of persons without college training find opportunities to establish and manage their own business enterprises. Furthermore, in large firms some outstanding employees who are not college graduates continue to move upward into executive jobs. However, advancement to administrative positions is becoming much more difficult for such individuals. To a steadily increasing extent, companies are hiring business administration majors or other college graduates as executive trainees and filling administrative positions by promotion of these trainees or of professional personnel such as engineers or accountants. Even for college-trained employees, promotion to administrative jobs normally requires many years of experience, and only a few outstanding individuals can hope to achieve top level positions.

To prepare students for managerial jobs in industry, colleges and universities have set up special courses of study in business administration. The number of students graduating from these

CHART 16



courses increased very rapidly following World War II (as shown in chart 16). The tremendous flow of veterans and other students into business courses was reflected in the record number of business and commerce graduates in 1950 (72,000). In 1958, after the World War II veterans' education program had tapered off, there were 51,000 graduates of business and commercial courses, nearly 3 times as many as before the war. Business education is now second only to teacher training as a field of college education; graduates with majors in business administration outnumber those in such large fields as engineering, law, and medicine.

In all probability, the number of business administration graduates will continue to rise, as the total number of college graduates increases. It is also likely that the emphasis on college training in selecting personnel for executive positions in industry will increase further. However, there will continue to be many opportunities for persons without college training to establish and manage their own small businesses.

Employment Trends

Administrative and managerial work is a growing field of employment in the United States. The proportion of workers employed as proprietors, managers, and officials showed a steady rise in each decade from 1910 to 1950, increasing from 6.6 percent to 8.7 percent of the labor force during the 40-year period.

The numbers of proprietors and managers rose sharply after the end of World War II, as many veterans opened their own businesses and companies filled administrative positions which had to be left vacant during the war because of the manpower shortage. A peak (6.4 million) was reached in 1949, and in the next few years the numbers of proprietors and managers either declined slightly or remained approximately the same. However, since 1954, employment in this broad occupational group has risen each year and, in 1958, reached about 6.8 million—a new peak.

A marked expansion in business activity and total nonagricultural employment is expected in the United States over the long run. Some increase in the number of executive jobs will no doubt accompany this general increase in employment. However, the gains in employment of proprietors and managers as a group will probably be slow.

In salaried administrative positions, the main source of new job opportunities will be the need to replace executives who retire from business or die. In general, the top jobs will, of course, be filled by promotion of workers already employed in intermediate executive positions. However, these promotions will open opportunities farther down the ladder and will make room at the bottom for new graduates to enter as trainees. In view of the large proportion of executives in high-ranking administrative and technical jobs in industry who are in the upper-age brackets, a substantial percentage of these executives will have to be replaced during the next decade. Because of this situation, there are likely to be favorable opportunities for well-qualified young men to enter administrative work in the 1960 decade.

A number of managerial jobs are discussed in separate occupational reports in this Handbook. Among these jobs are those of hotel manager, restaurant manager, department store buyer, and bank officer. Accountants and personnel workers are examples of occupational groups, important in the management of many types of business enterprises, which offer opportunities for advancement to high-level administrative jobs. Many members of other professions, such as engineers, chemists, and lawyers, also advance to administrative positions in industry and government. (See index for page references.)

TEACHING

Teaching is the largest of all the professions. More than 1½ million men and women in the United States are full-time teachers, and thousands of others teach on a part-time basis. Many scientists, physicians, accountants, and members of other professions teach one or more classes in colleges and universities; similarly, large numbers of carpenters, mechanics, and other craftsmen teach part time in vocational schools. Many other people also teach on a part- or full-time basis in adult education programs or in commercial, industrial, or governmental training departments.

No other profession offers so many employment opportunities to women as teaching; even the large field of nursing employs fewer than half the number of women engaged in teaching. Women teachers far outnumber men in kindergarten and elementary schools. However, the numbers of men and women are about equal in secondary (that is, junior and senior high) schools, and men hold about three-fourths of all college and university teaching positions.

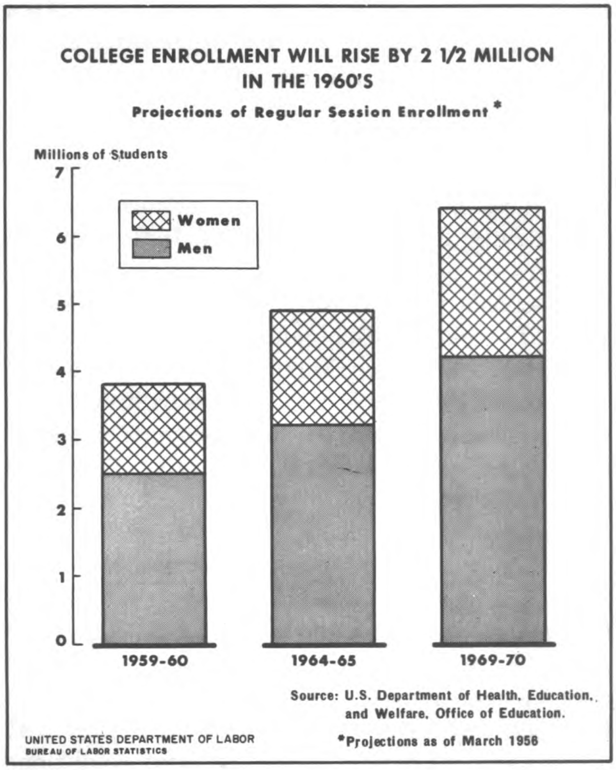
The number of teachers needed by the Nation's schools depends chiefly, of course, on the number of pupils enrolled. In the fall of 1958, the U.S. Office of Education estimated that 45 million people—nearly one-fourth of the country's population—were enrolled in the Nation's schools and colleges. These enrollments (an all-time high) were distributed among the schools and colleges as follows: 71 percent in the elementary grades; 20 percent in high schools; and 9 percent in universities, colleges, and other types of educational institutions. Some shifts in the relative numbers of students at different educational levels occur as the age distribution of the school-age population changes. For example, the high birth rates of the 1940 decade brought unprecedented increases in elementary school enrollments in the early 1950's. By the mid-1950's, the increased numbers of children were beginning to enter the high schools, and toward the end of the decade the colleges were feeling the impact of the high birth rates.

In the future, enrollments above the elementary school level are expected to increase at a greater rate than the school- and college-age population, because of the persistent increase in the proportion of young people attending high school and college. For many years, nearly all children 6 through 13 years of age have been enrolled in school, but in the last 25 years there has been a spectacular rise in the proportion of youths of high school age (14 through 17 years) and college age (18 through 21 years) attending educational institutions. In 1930, only about half the group 14–17 years of age attended school; by 1958, nearly 90 percent of this group were enrolled. Similarly, the proportion of the college-age population in educational institutions increased from about 12 percent in 1930 to more than 35 percent in 1958. It is likely that these trends will continue, particularly at the college level.

On the basis of population trends and a conservative allowance for further growth in the proportion of high school graduates entering college, a remarkable rise is anticipated in college and university enrollment during the 1960 decade, as shown in chart 17. Sizable increases are expected also in enrollments in elementary and secondary schools.

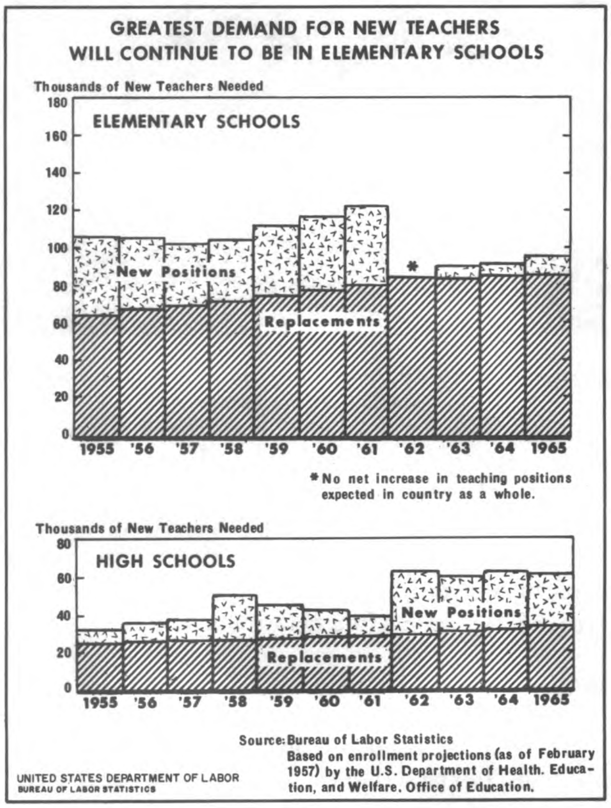
To staff the new classrooms that must be provided for the rising numbers of students, tens of thousands of additional teachers will be needed annually. Moreover, still greater numbers will be required, particularly in elementary and high schools, to replace those who leave the profession. (See chart 18.) Although precise information is not available on the number leaving the field each year, it is conservatively estimated that at least 8 percent of the elementary and 5 percent of the high school teachers leave teaching annually. Using these replacement rates and assuming 1 teacher for each 30 new pupils in the lower grades and 1 for each 25 pupils in high schools, an estimate has been made of the annual demand for new teachers for elementary and secondary grades. The number of new teachers needed

CHART 17



through grade 12 is expected to average about 155,000 (100,000 in elementary and more than 50,000 in secondary schools) each year during the first half of the 1960 decade. Estimates of the demand for teachers at each educational level—in elementary and secondary schools, and also in colleges and universities—are discussed in the following statements. A statement on the specialized field of school counseling is also included in the chapter.

CHART 18



Kindergarten and Elementary School Teachers

(D.O.T. 0–30.02 and .11)

Nature of Work

Elementary school teaching is the largest field of professional employment for women and is also a growing field for men. In 1958–59, more than 800,000 classroom teachers (87 percent women) and several thousand principals and supervisors were employed in public elementary schools. In addition, more than 100,000 teachers were employed in parochial and other private schools.

Kindergarten and elementary school teachers usually work with one group of pupils during the entire school day, teaching a wide range of subjects and supervising various activities such as lunch and play periods. However, in some school systems, teachers in the upper elementary grades may instruct several groups of pupils in one or two subjects. Many school systems also employ special teachers of art, music, physical education, industrial arts, and homemaking. Teachers in schools with only a few students, especially in rural areas, may have to teach all subjects in more than one grade.

Although the time spent in the classroom is usually less than the average working day in many other occupations, the elementary school teacher must spend additional time each day on

Elementary school teaching is the largest field of professional employment for women.

such activities as planning work, preparing instructional materials, developing tests, checking papers, making out reports, and keeping records. Conferences with parents, meetings with school supervisors, and other professional activities also frequently occur after classroom hours.

Where Employed

Elementary school teachers are employed in all cities, towns, villages, and in many rural areas. About half the teachers in grades 1 through 8 and nearly all the kindergarten teachers are in towns and cities with more than 2,500 population. Although the number of 1-room schools is decreasing as a result of reorganization of school districts, about 35,000 teachers are still employed in these schools, which are located chiefly in the North Central States—particularly in Iowa, Nebraska, and Wisconsin.

Training and Other Qualifications

All States require every teacher in the public schools to hold a certificate. The amount of education required for certification differs considerably from State to State, but there is a steady trend toward uniform educational standards. In 1957, 35 States, the District of Columbia, and Hawaii issued regular teaching certificates only to persons with at least 4 years of approved college preparation, and 10 other States and Alaska required at least 2 years. The other three States gave regular certificates for teaching in the public elementary schools to persons with 1 year or less of preparation on the college level. Some school systems have educational requirements higher than those necessary for State certification.

The only States which, as of 1957, required teachers in parochial and other private elementary schools to hold certificates were Alabama, Iowa, Louisiana, Michigan, Montana, Nebraska, New Hampshire, New Mexico, South Dakota, and Vermont. But since most States refuse to accredit schools unless the teachers are properly certificated, administrators of all types of schools generally prefer to employ teachers meeting State certification requirements.

In nearly all States, certificates are issued by State departments of education on the basis of transcripts of credits and recommendations from approved colleges and universities. Certificates may be issued to teachers from other States if the necessary programs have been completed at accredited colleges. Under certain conditions most States also issue provisional certificates which enable a partially prepared teacher to begin teaching, but which specify the provisions for annual renewal until regular certification requirements have been met.

Every State and many individual school systems have certain additional requirements for public school teaching. For example, 21 States require a health certificate, 28 require United States citizenship or at least filing of the first papers, and 26 require an oath of allegiance. The prospective teacher should find out about the exact requirements of the area in which he plans to work by writing to the State department of education or to the superintendents of local systems.

Most institutions of higher education offer teacher preparation. In a 4-year teacher-preparation curriculum, the prospective elementary school teacher spends roughly one-fourth of the time in learning about children, the place of the school in the community, and materials and methods of instruction—including practice teaching in an actual school situation; the remainder of the time is devoted to studying cultural and related subjects common in the usual liberal arts program. Kindergarten and elementary school teachers seldom have a subject-matter major; most of them receive degrees in education.

Inexperienced teachers often start in rural schools or small town systems. Opportunities for advancement may come through annual salary increases in the same school system; transferring to a system with a higher salary schedule which recognizes experience gained in another school system; by appointment to a supervisory, administrative or specialized position; or by obtaining additional preparation.

Employment Outlook

Many thousands of openings for elementary school teachers will occur each year throughout the 1960's. Enrollments in kindergarten and grades 1 through 8 will continue to rise during this period but possibly at a slower rate than in the preceding decade. As a result, the demand for teachers to staff new kindergarten and elementary school classrooms is expected to level off in the 1960's. Nevertheless, an average of more than 10,000 new teachers will be needed annually to take care of the increase in enrollment. In addition, an even greater number will be required as replacements. (See chart 18.) Each year, a large number of young women enter the teaching profession and then withdraw because of marriage or for other reasons. In addition, many teachers will reach retirement age. It is conservatively estimated that more than 85,000 elementary school teachers will be needed annually to replace those who will leave in the 1960's.

Altogether, the need for new elementary and kindergarten teachers will average about 100,000 each year during the 1960 decade unless replacement rates are reduced considerably. This figure does not provide for additional teachers needed to bring about improvements, such as lower pupil-teacher ratios in overcrowded classrooms, replacement of persons not meeting regular requirements, and extension of kindergarten facilities to all areas.

The number of students preparing for elementary school positions each year is likely to continue to fall short of the demand for new teachers. For example, in 1958, only 52,000 students qualified for such teaching positions whereas twice that number were needed. Some expansion in the supply of qualified teachers is expected, owing to the increasing college-age population and the offering of special incentives such as those provided by the National Defense Education Act of 1958 under which financial aid is given to students who desire to enter the teaching profession. As in the past decade, the deficiency in the supply of elementary school teachers will probably continue to be met by issuing short-term emergency certificates to teachers not meeting regular requirements, by increasing the size of classes, by the reentry of former teachers into the profession, and by attracting qualified personnel from other fields of work. Shortages will tend to be greatest in areas where teachers' salaries are lowest or where there are many better paying employment opportunities in other fields.

Barriers to the employment of certain groups, particularly married women and older men and women, are being continually reduced, largely because of teacher shortages. Members of these groups tend to find opportunities especially good in their own small communities, where lower salaries or isolated living conditions may not attract nonresidents.

Earnings and Working Conditions

The average (median) salary for beginning public elementary school teachers was $3,450 in 1956–57, according to a survey made by the U.S. Office of Education. The average salary for men in their first year of teaching was $200 higher than for beginning women teachers. Inexperienced teachers in large urban schools earned $3,700, on the average; in small urban schools, $3,400; and in rural schools, $2,700.

Teachers usually receive salary increases based on length of experience and additional education. According to the National Education Association, the estimated average salary for all classroom teachers in public elementary schools—including teachers with various amounts of experience—was $4,575 in 1958–59. Teachers in 3 States (Alaska, New York, and California) had salaries averaging more than $5,500; in 10 States (7 in the South and Nebraska, North Dakota and

South Dakota), salaries averaged less than $3,500.

Teachers' salaries are usually lowest in rural schools and highest in large city systems, where educational and experience requirements are likely to be high. According to a survey by the National Education Association, median salaries for elementary school teachers and principals in public urban schools in 1956–57 were as follows:

Population of city	Classroom teachers	Principals: Teaching	Principals: Supervising
2,500–4,999	[1] $3, 946	$4, 395	$5, 500
5,000–9,999	[1] 4, 086	4, 590	5, 851
10,000–29,999	[1] 4, 317	4, 927	6, 185
30,000–99,999	4, 454	5, 174	6, 538
100,000–499,999	4, 442	4, 905	7, 007
500,000 and over	5, 579	[2] 8, 557	9, 101

[1] Includes kindergarten teachers.
[2] Assistant principals only.

Most schools are in session about 9 months a year. Teachers therefore have a long vacation period, during which they often work at other jobs or take summer courses for professional growth or to help them obtain advancement and salary increases.

Some form of retirement, often under the Government social security plan, is provided for most teachers. Nearly all school systems have some provision for sick leave and an increasing number grant other types of leave with pay.

Where To Go for More Information

Information on schools and requirements in a particular State is available from the State department of education at the State capital.

General information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D.C.

National Education Association,
1201 16th St. NW., Washington 6, D.C.

Secondary School Teachers

(D.O.T. 0–31.01 and .10)

Nature of Work

Secondary school teachers—those employed in junior and senior high schools—usually specialize in a subject-matter field such as English, history, mathematics, or science. They teach several classes every day either in their main field only or in that field and one or two related subjects. The most frequent combinations are English and history or other social science subjects; mathematics and general science; and chemistry and biology or general science. Teachers in fields such as home economics, agriculture, commercial subjects, driver education, music, art, and industrial arts are less likely to have classes in other subjects.

Besides giving classroom instruction from 20 to 30 hours each week, secondary school teachers also develop and plan teaching materials, develop and correct tests, keep records, make out reports, consult with parents, and perform other duties. Many of them supervise student extraclass activities—sometimes after regular school hours. Maintenance of good relations with parents, the community, and fellow teachers is an important aspect of their jobs.

More than 500,000 teachers, principals, and supervisors were employed in the Nation's public and private secondary schools in 1958–59 to teach about 9 million pupils. Nearly half the classroom teachers in public secondary schools were men; the proportion of women was somewhat higher in private schools. Men outnumber women in supervisory and administrative positions in both public and private schools.

Where Employed

Secondary school teachers are employed in 4-year high schools (grades 9–12), 3-year junior high schools (grades 7–9), 3-year senior high schools (grades 10–12), and 6-year combined junior-senior high schools (grades 7–12). About 40 percent of the public secondary schools, enrolling about 25 percent of the pupils, are of the 4-year type; the majority of these are in towns with a population of less than 2,500. Most of the separately organized junior high schools are in large cities.

Although nearly half of all secondary school teachers are employed in cities of 10,000 or more population, about one-third teach in communities with less than 2,500 population.

Training and Other Qualifications

A certificate is required by each State for public secondary school teaching. The usual educational requirement for a State certificate is a bachelor's degree, with the equivalent of at least one-half year of education courses, including student teaching, and specialization in one or more subjects commonly taught in secondary schools. The States of Arizona, California, and New York, and the District of Columbia grant secondary certificates only to people with a year of graduate work. Many school systems, especially in large cities, have requirements beyond those needed for State certification. Some systems require additional educational preparation, successful teaching experience, or special personal qualifications.

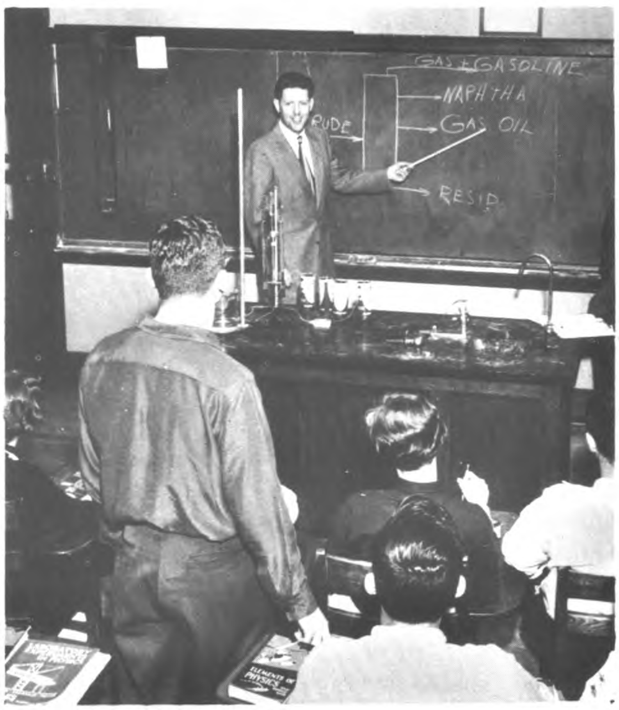
College students preparing for secondary school teaching usually devote from one-fourth to one-third of the 4-year course to their major, which may be a single subject or a group of related subjects. About one-fifth of the time is spent in education courses—learning about youth, community life, and materials and methods of instruction. The remaining time is devoted to general or liberal education. Satisfactory teacher-preparation curriculums are offered by universities with schools of education, by colleges with strong education departments and adequate practice-teaching facilities, and by teachers' colleges.

Although certification requirements vary among the States, the person who is well prepared for secondary school teaching in one State usually has little trouble meeting requirements in another State. A well-qualified teacher can ordinarily obtain temporary certification in a State while he prepares to meet any unusual requirements.

Qualified secondary school teachers may advance to positions as supervisors, assistant principals, principals, superintendents, or other administrative officers. At least 1 year of professional education beyond the first college degree and several years of successful classroom teaching experience are usually required for most supervisory and administrative positions. A few experienced teachers are assigned to positions as part- or full-time guidance counselors, visiting teachers who instruct in the pupils' homes, or instructors of handicapped or other special groups. Additional preparation is usually required for these assignments.

Employment Outlook

A growing number of secondary school teachers will be needed during the 1960's, when enrollments will expand rapidly as a result of the high birth rates following World War II. The great increase in population reaching high school age, combined with the trend for a growing proportion of young people to enter and graduate from high school, will result in a demand for more than 20,000 teachers each year, on the average, to handle new classes during the early 1960's. The number of teachers needed in the last half of the decade may be only slightly lower. Throughout the 10-year period, vacancies created by turnover will exceed the number of new positions. (See chart 18.) Altogether the number of secondary school teachers that



Teachers of physics are in short supply.

must be recruited each year is likely to average more than 50,000 during the 1960's.

The supply of persons who will be available to fill teaching positions each year is difficult to estimate. Although most of the new teachers are drawn directly from college graduating classes, some positions are filled each year by the reentry of former teachers (many of whom dropped out to care for their young children), by persons not meeting certification requirements, and by fully qualified persons who have been in other types of employment. Not all qualified new graduates seek teaching positions. For example, in 1957, when approximately 65,000 college graduates met certification requirements for secondary school teaching, more than a third, by the fall of that year, were employed in positions other than teaching, were engaged in graduate study, were in the military service, had become homemakers, or were otherwise lost to the teaching field. Similarly, a large proportion of the 72,000 potential teachers graduated in 1958 were not available for teaching positions. Should this situation persist throughout the 1960 decade, well-qualified candidates seeking to enter secondary school teaching will find employment opportunities in most geographic areas and in most subject fields.

Employment opportunities for teachers are expected to continue to be best in science, mathematics, industrial arts, and other subject fields where the demand in private industry is also great, unless there is a considerable decline in economic activity with resulting unemployment. Under conditions of economic decline, teaching would, as has been demonstrated historically, become a highly competitive field and certification requirements would probably be raised.

Earnings and Working Conditions

The average (median) salary for beginning public secondary school teachers was $3,600 in 1956–57, according to a survey made by the U.S. Office of Education. Men teachers earned $3,700 and women earned $3,450, on the average. Inexperienced teachers in large urban schools earned $3,800, on the average; in small urban schools, $3,700; and in rural schools, $3,400.

The estimated average annual salary for all classroom teachers in public secondary schools—including both experienced and beginning teachers—was about $5,110 in 1958–59, according to the National Education Association. In a few Southern States, their average salary was less than $3,500. In Alaska, New York, and California, it was more than $6,000.

Junior high school teachers frequently receive somewhat lower salaries than high school teachers in the same school system; however, the trend is toward equalizing salaries of teachers with the same educational preparation regardless of grade taught and regardless of sex. Teachers of vocational education, physical education, and other special subjects often receive higher salaries for their work than do other teachers in the same school. Under the salary schedules in effect in most school systems, teachers in all subject fields receive regular salary increases as they gain experience and additional education.

Salaries of teachers are usually lower in towns and small cities than in larger cities, but educational and experience requirements in large city school systems are likely to be higher. On the average, salaries of principals in the largest cities, where administrative responsibilities are great, are much higher than in towns and small cities. According to a survey by the National Education Association, median salaries for classroom teachers and principals in public urban secondary schools in 1956–57 were as follows:

	Classroom teachers		*Principals*	
Population of city	*Junior high*	*High school*	*Junior high*	*High school*
2,500–4,999	$3, 875	$4, 297	$4, 967	$5, 752
5,000–9,999	4, 282	4, 496	5, 963	6, 304
10,000–29,999	4, 540	4, 866	6, 571	7, 143
30,000–99,999	4, 783	5, 135	7, 198	7, 958
100,000–499,999	4, 522	5, 028	7, 481	8, 232
500,000 and over	5, 565	6, 326	9, 439	10, 788

It is not uncommon for teachers to add to their incomes by teaching in summer school sessions, working as camp and recreational counselors, or doing other work. However, many teachers use their vacation periods to work toward advanced degrees or to take specialized courses. Some teachers supplement their incomes during the regular school year in various ways. For example, they may teach in adult education or other evening classes, work part time in business or industry, or write for publication.

Some form of retirement, often under the Government social security plan, is provided for most teachers. Nearly all school systems have some provision for sick leave and an increasing number grant other types of leave with pay.

Where To Go for More Information

For information on Vocational Agriculture Teachers see page 727.

Information on schools and requirements in a particular State is available from the State department of education at the State capital.

General information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D.C.

National Education Association,
1201 16th St. NW., Washington 6, D.C.

College and University Teachers

(D.O.T. 0–11.50)

Nature of Work

More than 300,000 faculty members were employed in the Nation's 1,900 colleges and universities in 1958. However, only about 175,000 of these staff members were engaged in full-time teaching. At least 100,000 were in part-time teaching positions, especially in such fields as medicine, law, and business administration. The remainder of the faculty members were employed in administrative work, full-time research, library work, or other educational activities. Men predominated in most college teaching fields and held about 95 percent of the positions in engineering, the physical sciences, agriculture, law, and philosophy. Only about one-fourth of all college and university teachers were women; however, they were in the majority in nursing, home economics, and library science.

College and university teachers instruct students in specific subject fields. More than half of all faculty members teach courses in social science, fine arts, English, physical science, education, or engineering. In many 4-year institutions, the usual teaching load is from 12 to 15 hours a week. Associate professors and full professors—who usually teach the more advanced courses in a subject field and advise students studying for graduate degrees—may spend only 6 or 8 hours a week in actual classroom work. On the other hand, beginning college teachers (including instructors and some assistant professors) may spend 20 hours or more each week teaching classes. Those with heavy teaching schedules usually have two or three sections in the same subject so that separate preparation is not required for each class.

Besides teaching classes, college teachers spend a considerable amount of time preparing tests and other materials for classroom use, checking and grading student work, and keeping up to date with developments in their specialties. Many faculty members carry on research projects, write for publication, take part in college administration, or lecture to civic and professional groups. Some professors act as consultants to business, industrial, scientific, or government organizations.

Where Employed

More than half of all faculty members are employed by universities. The next largest group (about 20 percent) is in liberal arts colleges. Between 5 and 10 percent are employed by teachers' colleges, and roughly the same proportion are on the faculties of community (junior) colleges. The remaining small group (less than 5 percent) is in technological, theological, and other professional schools.

Some States have many more colleges and universities than others, owing primarily to differences in the size of the population. For example, some Western States have less than 10 colleges and only a few hundred faculty members. On the other hand, a few States with the largest populations each have more than 100 institutions and more than 10,000 faculty members. About half of all college and university teachers are employed in the following eight States, in each of which college enrollments exceeded 100,000 in 1958: New York, California, Pennsylvania, Illinois, Massachusetts, Texas, Ohio, and Michigan.

Training and Other Qualifications

To qualify for most beginning positions in college teaching, applicants must have at least the master's degree; and for many such positions they must have completed all requirements for the doctorate except the dissertation. The doctor's degree is often, but not always, required for promotion or appointment to positions above the rank of instructor. In general, the doctorate is most important for teaching positions in psychology, biological sciences, physical sciences, social sciences, philosophy, and religion; it is least likely to be a requirement in fields such as health and physical education, fine arts, engineering, business and commerce, and home economics. Teaching in public junior colleges in a number of States, including California, Illinois, Florida, New Jersey, and Michigan, is dependent upon State certification which usually requires the master's degree and completion of certain types of courses in education.

To enter college teaching one must be a specialist in some subject field. However, undergraduate courses in the humanities, social sciences, and natural sciences, and the mastery of at least one foreign language are an important part of the educational background needed for teaching. Intensive instruction in the selected field of specialization is given in graduate school. During graduate work, outstanding students may be employed as part-time assistants to aid in teaching undergraduates. Such work affords valuable experience for the prospective teacher. Some colleges offer other means, such as informal seminars or meetings, by which the graduate students can develop teaching competence. A good many beginning college teachers—especially those in education departments—have had some experience in high school or other types of teaching.

Most 4-year colleges and universities recognize four academic ranks: Instructor, assistant professor, associate professor, and full professor. Few institutions grant tenure (full status as a member of the staff on a continuing basis) or give advancement to instructors with less than 3 years of service. Assistant and associate professorships are generally attained only after extensive graduate training or experience. To advance to the rank of full professor usually requires from 10 to 15 years of successful college teaching experience, as well as the doctor's degree. Outstanding achievement, generally through research or publications, often hastens advancement.

Employment Outlook

Openings for new entrants to college teaching will be numerous in the early 1960's and will increase greatly during the latter part of the decade. Opportunities will be best for those with doctoral degrees and those who have completed all requirements for the doctorate except the dissertation. Nevertheless, there will be many employment opportunities for new entrants with only the master's degree, particularly in junior colleges.

A great increase in college enrollment is in prospect. The number of young people in the 18- to 21-year-age group will rise by 5 million during the 1960's. At the same time, it is likely that the extension of college education to a higher proportion of young people will continue—owing to such factors as rising family income, greater demand for college-trained personnel, and the increasing number and proportion of the population who finish high school and are, therefore, eligible to enroll in college. The anticipated increase in the number of community colleges and schools offering evening classes, as well as the greater availability of scholarships and other student financial aids, will also tend to make it possible for more young people to attend college. Assuming a moderate increase in the proportion of the 18–21 year-olds attending college (less than 1-percent increase each year) and assuming that training facilities will be available, the number of students in 1970 will be double the 1958 enrollment. To handle this increase in enrollments, an average of about 15,000 additional full-time teachers will be needed annually in the early 1960's and more than 20,000 each year during the late 1960's.

Besides the new teachers needed to take care of expanding enrollments, an average of at least 10,000 is likely to be required annually in the 1960's to replace persons who will retire, die, or otherwise leave the profession. The number leaving teaching each year to enter other types of employment will depend primarily on the level of business activity and on conditions in the academic profession itself.

The supply of new college teachers comes largely from students receiving graduate degrees. The U.S. Office of Education estimates that the number of doctorates conferred during the 1960 decade will average about 15,000 a year and that the number of master's degrees will average close to 110,000 annually. It is impossible, however, to predict the proportion of graduates who will enter teaching. In 1957, when the demand was probably for about 20,000 new teachers, more than 70,000 persons received graduate degrees; nevertheless, shortages of teaching personnel were reported in several fields, particularly in the physical sciences, engineering, and mathematics. Some increase in the supply of college teachers is anticipated because of Federal legislation enacted in 1958, which will make more fellowships available to graduate students interested in college teaching as a career. Nevertheless, it is likely that the number of well-qualified persons available for teaching positions will continue to be insufficient to meet the demand in many subject fields throughout the 1960's. (See index for page numbers of separate statements on each profession.)

Earnings and Working Conditions

Average (median) salaries of full-time college teachers employed on a 9-month basis during the academic year 1957–58 were $4,562 for instructors, $5,595 for assistant professors, $6,563 for associate professors, and $8,072 for professors, according to a National Education Association survey. Salaries for most instructors were between $3,600 and $5,600 for 9 months of full-time teaching; most assistant professors earned between $4,400 and $6,800; associate professors $5,000 to $8,200; and professors $5,800 to $11,400.

Salaries of teachers tend to be lowest in community colleges, small liberal arts colleges, and women's colleges; they are highest in State universities, technological institutes, and large privately controlled universities. According to a survey made by the American Association of University Professors, average salaries in 1957–58 for teaching personnel in selected privately controlled institutions in New England and the Middle Atlantic States were as follows:

3 women's colleges	$6, 650
6 small institutions	7, 320
5 medium-size institutions	7, 550
5 large institutions	8, 120

Faculty members who teach the year round receive higher salaries than those who are employed for the academic year only. Moreover, teachers in professional schools (medicine, dentistry, etc.) and graduate schools generally receive higher salaries than teachers in undergraduate colleges.

Many faculty members have some professional income in addition to their regular salaries. The chief source of supplementary income is other teaching (often in summer sessions) not a part of the teacher's regular duties. Consulting work is a major source of extra income, particularly for teachers of engineering and physical sciences. A few teachers have considerable income from lecturing and from royalties on publications. Those who have achieved professional recognition are the most likely to be offered opportunities to supplement their regular salaries.

Retirement plans differ considerably by institution, but an increasing number of colleges and universities are participating in the Government social security program, often as an accompaniment to plans of their own. The greatest number of institutions have set 65 years as the retirement age, though nearly as many stipulate 70 years. In any case, most institutions permit exceptions to the age limit.

Most colleges and universities provide sabbatical leaves of absence—typically, 1 year's leave with half salary or a half year's leave at full salary after several years of employment; other types of leave for advanced study; life, sickness, and accident insurance; reduced tuition charges for children of faculty members and other benefits.

Where To Go for More Information

Information on college teaching as a career is available from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D.C.

American Association of University Professors, 1785 Massachusetts Ave. NW., Washington 6, D.C.

National Education Association, 1201 16th St. NW., Washington 6, D.C.

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Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular fields. Names and addresses of societies are given in the statements on specific professions. (See index for page numbers.)

Additional information on employment conditions for college and university teachers and a discussion of the preparation needed to enter teaching are given in the pamphlet, College Teaching as a Career, available from the American Council on Education, 1785 Massachusetts Ave. NW., Washington 6, D. C.

Detailed information on salaries of faculty members in public and private institutions is contained in Circular No. 549, Higher Education, Planning and Management Data, 1958-59, U.S. Office of Education. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $1.

School Counselors

(D.O.T. 0-36.40)

Nature of Work

The job of the school counselor is to help pupils make realistic plans for school and work and to assist them in carrying out those plans and solving their personal problems. Besides counseling individual pupils, counselors supervise student group discussions and consult with classroom teachers, school administrators, parents, and others regarding the guidance of pupils. Many work only part time as counselors; they generally have teaching or administrative responsibilities as well.

The personal interview is the basic technique used by counselors to help students understand their interests and abilities and make appropriate plans. Counselors frequently use psychological and other tests which they or a psychometrist (a specialist who measures speed and precision of mental processes) may give with the assistance of other faculty members. They also collect and keep on file other information, such as previous school records and medical reports, to help them understand each pupil. They may work with psychologists, medical personnel, community agencies, and employers, as well as with school personnel.

Counselors in junior and senior high schools help students decide on a field of work, arrange for courses which fit in with their plans, and select college or other type of advanced training, in addition to handling problems related to school and social adjustments. They may also assist students in finding part-time work while in school or full-time employment after leaving school. To aid pupils in making career plans, counselors may maintain libraries of occupational materials, arrange for educational movies, plan and conduct career day programs, and arrange trips to factories and colleges. Many of them make followup studies of recent graduates or dropouts and cooperate in surveys of job opportunities in the community.

In elementary schools, counselors work with classroom teachers, helping them to understand and meet the needs of the individual children in their classes. These counselors also confer with parents and spend considerable time working directly with children referred for counseling services by teachers, principals, parents, and agencies. The methods used in counseling young children are often necessarily different from those used for older pupils. Special tests and play activity are among the techniques used in the lower grades.

Many counselors in both elementary and secondary schools teach some regular classes and may perform a variety of other duties such as supervising school clubs or other extra-class activities (sometimes after regular school hours). In many schools, they do their own recordkeeping and other paper work; however, an increasing number of schools are providing clerical assistance.

Where Employed

According to a 1956 survey, approximately 44,000 people were engaged in counseling in the Nation's public schools. Included were 10,000 who devoted full time to counseling activities, 8,000 who spent half or more of their time (but less than full time) in counseling, and 26,000 who spent less than half time in counseling. Nearly three out of four of these counselors were employed in junior and senior high schools. Almost half of the counselors in public secondary schools were men; the proportion of women was much higher in elementary schools.

There is great variation among States and among city school systems within a State in the emphasis placed on counseling and the employment of specially trained counselors. In general, large schools in urban areas are more likely to employ specialized counselors than are smaller schools in rural areas.

Training and Other Qualifications

All school counselors must have State teaching certificates. In addition, as of mid-1958, 29 States and the District of Columbia required special certificates for school counseling. Special certification was provided for but was optional in seven other States. Counselor certification requirements in most States include a master's degree or its equivalent in counselor education as well as several years of teaching experience. At least 1 year of work experience other than teaching is a requirement in about half the States providing for certification.

College students preparing to be school counselors usually follow the regular curriculum for teacher education on the undergraduate level; in addition, courses in psychology and sociology are desirable. Most employers prefer that counselors have teaching experience before or while studying for the advanced degree in guidance. In some school systems, teachers who have completed half of the required courses for a master's degree may counsel under supervision while studying additional subjects. Among the subjects usually required are those dealing with the counseling process, understanding the individual, and educational and occupational information. Supervised practice in guidance is included in many training courses. Some knowledge of statistics is necessary for interpreting tests.

It is especially important for counselors to be well adjusted, even tempered, and able to inspire the confidence of students. In a recent survey, school principals given a list of qualifications indicated that they considered the following items most important in selecting counselors: (a) personality factors, such as emotional stability and maturity, (b) successful teaching experience before entry into counseling, and (c) graduate study in guidance.

An experienced counselor may advance to a position as head of the guidance department of a large school or director of guidance with the county or city board of education. Related fields of employment for persons with guidance training include student personnel work in colleges, work in public or private vocational guidance centers, or industry personnel work.

Employment Outlook

Employment of school counselors, which has risen rapidly since World War II, is expected to increase through the early 1960's. The shortage of qualified counseling personnel appeared, in 1958, to be the major factor limiting the expansion of employment.

In the next few years, the number of openings for counselors is expected to rise both as a result of the expansion of existing counseling activities and the introduction of counseling services in schools that do not now offer them. Estimates made by public school principals in 1956 indicated that about 75,000 persons might be engaged, full time or part time, in counseling by 1960–61—roughly two-thirds more than 5 years earlier. Guidance programs in elementary schools may expand at a rate greater than in secondary schools. Estimates made by principals of elementary schools in 1956 suggested an increase of as much as 18,000 by 1960 in the number of staff members doing some counseling work. Principals also looked forward to having relatively more counselors who would devote full time to counseling activities. Schools will be assisted in strengthening their counseling activities by Federal legislation (National Defense Education Act) enacted in 1958. This provides for financial aid to States to assist in the training of counselors and in establishing guidance programs.

In the long run, the extension of guidance services, the continuing rise in school enrollments, and the replacement of counselors who leave the field should provide an increasing number of openings for qualified workers. However, employment opportunities in particular areas will depend upon such factors as the wealth of the community and the opinion of school administrators and the general public concerning the need for such services. Although school principals appear desirous of establishing better guidance programs, the problem of financing these services is often a difficult one. In recent years, however, budget allocations for counseling activities have been growing and this trend is expected to continue. There is a growing awareness of the value of guidance services in helping to solve problems pertaining to juvenile delinquency, school dropouts, occupational choice, and job dissatisfaction. Moreover, the importance of identifying and counseling talented students, especially in critical occupational areas such as science and engineering, is focusing attention on the role of the school counselor.

Earnings and Working Conditions

Many school counselors have annual earnings somewhat higher than those of classroom teachers with similar educational preparation and experience. (See statements on elementary and secondary school teachers.) Some counselors work 1 or 2 months more each year than classroom teachers. Furthermore, some school systems pay counselors an additional amount which is not dependent on the length of their work year.

In most school systems, counselors receive regular salary increases as they gain additional counseling experience and education. Directors and supervisors of guidance in urban school districts of 10,000 to 30,000 population had median (average) salaries of about $5,600 in 1956–57; those in smaller districts made somewhat less and those in large districts made much more, on the average. A few counselors supplement their income by writing textbooks or acting as consultants for private or public counseling centers, government agencies, or private industry.

Where To Go for More Information

Information on specific certification requirements for counselors and institutions offering guidance training is available from the State department of education at each State capital. Information on certification requirements is also contained in the following publication: Guidance Workers Certification Requirements, U.S. Department of Health, Education, and Welfare, Office of Education, Bulletin No. 22, 1957. Available from Superintendent of Documents, Washington 25, D.C. Price 25 cents.

Information on counselor training, under the National Defense Education Act, and on other provisions of the act pertaining to State and local guidance programs is available from the U.S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D.C.

General information on the occupation of school counselor may be obtained from:

American Personnel and Guidance Association,
1605 New Hampshire Ave. NW., Washington 9, D.C.

HEALTH SERVICE OCCUPATIONS

Nearly everyone knows something about what doctors, dentists, and pharmacists do. Many people also have some first-hand knowledge of the duties of nurses, attendants, and other workers who take care of patients in hospitals. Less well known but likewise of great importance to the public health are the large number of people employed behind the scenes in other health service occupations such as laboratory or X-ray technician. Altogether, nearly two million people were employed in the health field in 1955.

Nurses, physicians, pharmacists, and dentists make up the largest of the professional health occupations; in 1955, numbers in these occupations ranged from about 100,000 dentists to more than 425,000 nurses. Among the smaller professions are those of the dietitian, optometrist, chiropractor, veterinarian, and osteopathic physician. Other health service workers, whose jobs generally require less training, include technicians of various types, as well as practical nurses, hospital attendants, and nursing aids. (See p. 269.)

Workers in the health field are employed in many kinds of places including hospitals, clinics, laboratories, pharmacies, nursing homes, industrial plants, private offices, and patients' homes. Those employed in health-related occupations are concentrated in the heavily populated and wealthy sections of the Nation and in big cities, but there are some in every village and town.

The health occupations are a major source of employment for women. Nursing, the largest of the major health service occupations, is second only to teaching as a field of professional employment for women. More than 9 out of 10 registered nurses are women; this is true also of practical nurses and dietitians. Women account for somewhat more than half the employed hospital attendants and medical and dental technicians.

Men predominate in most of the professional health occupations and account for at least 90 percent of all dentists, optometists, physicians, veterinarians, and pharmacists. These professions provide numerous opportunities for independent practice.

Health occupations offer employment opportunities for people at all levels of education. For example, in order to practice as a physician, dentist, or pharmacist, it is necessary to complete several years of preprofessional and professional college-level education and pass a State licensing examination. Less formal education—in many cases, high school plus 1 or 2 years of technical training—is needed to become a medical laboratory or other technician in the health field. Many health service occupations, including those of the practical nurse and hospital attendant, can usually be entered with still less training.

Employment in the health fields has been increasing and is expected to continue to grow. The country's expanding population and the rising health consciousness of the general public will be reflected in a growing demand for medical, dental, nursing, and other health services. In addition, such factors as the extension of hospitalization and other medical insurance plans, the rapid expansion of expenditures for medical research, and continued provision of health care for veterans and members of the Armed Forces and their families point toward the need for additional health personnel. Moreover, many new workers will be needed each year to replace those who retire, die, or—particularly in the case of women —leave the field for other reasons. Thus, there will be many opportunities for employment in the health occupations over the next decade.

Registered Professional Nurses*

(D.O.T. 0–33)

Nature of Work and Where Employed

Registered professional nurses furnish nursing services to patients, either by giving direct nursing care or by supervising allied nursing personnel. As the persons with primary responsibility for carrying out physicians' instructions and with independent nursing duties, professional nurses are important members of the medical health team. Generally, their main concerns are: Care of the sick and injured, prevention of illness, and promotion of good health. They perform such tasks as administering medications and treatments prescribed by a physician; observing, evaluating, and recording symptoms, reactions, and progress of patients; assisting in patient education and rehabilitation; improving the physical and emotional environment of patients; and instructing auxiliary nursing workers or students.

The 460,000 professional nurses employed at the beginning of 1958 made up the largest group of health workers; more than 50,000 of them were working part time. Nurses may be located almost anywhere in the country, since virtually all communities maintain some health facilities and services. About 98 percent of all nurses are women, although an increasing number of men are entering the profession.

In the nursing field, there are several distinct groups of professional nurses specializing in a particular type of patient care and treatment. The largest group of professional nurses (about 63 percent of the total) are *hospital nurses*, who are concerned mainly with the care and welfare of patients in hospitals and related institutions. Most are general duty nurses, who usually perform the more skilled bedside services, such as caring for a patient after an operation, assisting with blood transfusions and intravenous feeding, and giving medications. General duty nurses often assign to auxiliary workers other duties requiring less extensive training. Some hospital nurses are engaged primarily in administrative or supervisory work. Others specialize in a certain type of service, such as caring for mothers and new babies or assisting physicians in the delivery room or in the operating room.

Private duty nurses (about 15 percent of all professional nurses) are employed directly by patients or their families to give individual nursing care, usually when constant attention is needed. Private duty nurses work in hospitals and patients' homes, frequently in situations which require a considerable degree of independent judgment, since a doctor may not be readily available.

The third largest group of professional nurses are *office nurses* (approximately 8 percent of the total). Employed mainly by physicians in private practice or in medical clinics and occasionally by dentists, office nurses assist in the care of patients; may perform routine laboratory work; and may also take care of a doctor's appointments, records, and other officework.

Public health nurses (about 6 percent of all professional nurses) are employed by public and private health agencies, including city and county health departments, visiting nurse associations, and schools. They may visit patients in their homes or work in clinics, schools, or offices. Especially concerned with promoting good health and preventing disease and injury, public health nurses may work with community leaders, teachers, parents, and physicians in planning or operating a community health education program. Their diverse duties may include giving first-aid treatment or periodic nursing care as prescribed by a physician, helping prepare booklets and charts on home health and sanitation, demonstrating diet plans to groups of patients, and providing information on disease prevention to families of migrant workers.

Sometimes called industrial nurses, *occupational health nurses* (about 4 percent of all nurses) give nursing care principally to company employees in business and industry. Interested mainly in keeping employees well and on the job, they may work alone (with a doctor on call) or may be part of a health service department in a large organization. They give emergency treatment for injuries and minor illnesses occurring

*Prepared by the Women's Bureau, U.S. Department of Labor.

at work, arrange for further medical care when necessary, and offer health counseling. They may also assist with health examinations, keep health records of employees, and help develop programs to prevent or control occupational diseases or accidents.

To prepare nursing personnel, *nurse educators* (3 percent of all nurses) are employed by hospital nursing schools, colleges and universities, public vocational schools, and schools of practical nursing. Their primary duty is to teach students the principles and skills of nursing, both in the classroom and at the bedside. They devise teaching methods, help beginners put nursing theory into practice, and recommend facilities and materials needed in training.

Nurses are also engaged in numerous other specialties as, for example, performing research and analysis of nursing services and serving as executives of professional organizations or on State boards of nursing. Branches of the military service employ professional nurses as commissioned officers, and there are some nurses working overseas for social, religious, and welfare agencies or for the Federal Government.

Training, Other Qualifications, and Advancement

Three types of training programs, namely diploma programs, baccalaureate degree programs, and associate degree programs, offer the preparation required for professional nursing. Traditional diploma programs are conducted by hospital schools and last 3 years. The programs leading to a baccalaureate degree require 4 years of study in a college or university. The newer associate degree programs being introduced into an increasing number of junior and community colleges last approximately 2 years. In the fall of 1958, there were 1,164 programs of these three types in the United States and they had enrolled 113,518 students. Among these, there were 92,419 diploma students (81 percent), 19,195 baccalaureate students (17 percent), and 1,904 associate degree students (2 percent).

Graduation from high school is required for admission to all schools of nursing. Many schools accept only graduates in the upper third or half of their class. Demonstrated competence in science and mathematics may also be required. Some schools admit only persons between 17 and 35 years of age, but in most schools the upper-age limit has been relaxed.

In both hospital and collegiate schools, nursing preparation includes classroom work and clinical experience (actual nursing practice). The timing and location of these vary, of course, in different schools. Generally, the first few months, known as the preclinical period, are spent in the classroom—learning the fundamentals of such subjects as anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. Thereafter, nursing students are assigned to various hospital services and learn how to care for different types of patients. They work, for example, with medical and surgical patients, nursing mothers and children, orthopedic patients, and those with eye, ear, nose, and throat problems. In many collegiate schools, nursing students are assigned also to public health nursing agencies and learn how to care for patients in their homes.

In all good schools of nursing, general education is combined with nursing education. Usually, baccalaureate degree programs require that at least half the training time be spent on general academic subjects and the remaining time on nursing courses and practice. The associate degree programs, which also emphasize general education, include consolidated nursing courses and a minimum amount of repetitive nursing practice.

Tuition and other educational expenses vary widely among schools of nursing, ranging from no cost to $2,000 a year. In some hospital schools, services performed for the hospital by the nursing students compensate for all or part of the training costs. Colleges and universities, on the other hand, charge their regular fees for a full college curriculum. Tuition at junior and community colleges is usually less expensive than in other colleges and universities. Scholarships and loans for nursing education are available from nursing schools, colleges and universities, various civic and professional organizations, women's clubs, and business groups. One foundation recently granted scholarship assistance to candidates for baccalaureate degrees in nursing at 32 colleges and universities. For graduate work in nursing administration, supervision, and education, as well as for public health work, financial assistance is available through a Federal program administered by the United States Public Health Service, as well as from many private and public agencies.

A license is needed to practice professional nursing within each State. To obtain a license, a nurse must have graduated from a school approved by the State board of nursing and must pass a State board examination. All State boards use a uniform examination prepared by the National League for Nursing, but each State establishes its own passing grade. A nurse may be registered in more than one State either by examination or by endorsement of a license issued by another State. Examination and endorsement fees range from $5 to $30, depending on the State.

In addition to the necessary technical knowledge and skills, persons interested in a nursing career should have a genuine interest in people and a desire to care for the sick or injured. Also important are such personal qualifications as dependability, patience, cooperativeness, human understanding, and sympathy. In addition, nurses need good mental and physical stamina and an aptitude for chemistry and other natural sciences. Young people who wish to obtain some first-hand information about the basic requirements and opportunities of nursing, are advised to join one of the 2,300 Future Nurse Clubs, which have been organized in about one-tenth of the high schools of the country.

Hospital nursing usually begins with general duty work, from which nurses may advance to progressively more responsible supervisory positions, such as head nurse, supervisor, assistant director, and director of nursing services. Opportunities for advancement are open to all graduate nurses, but those with baccalaureate degrees usually progress the most rapidly. A baccalaureate degree is usually desired for supervisory and administrative work, as well as for the fields of nursing education and public health nursing. Because of the shortage of degree nurses, however, some public health agencies are hiring staff nurses who have not received training in public health nursing, but advancement in these agencies is usually possible only with a baccalaureate or advanced degree. In other nursing fields, advanced education in a functional specialty (administration or teaching) or in a clinical specialty (pediatrics, obstetrics, psychiatry, or surgical nursing) also increases nurses' chances for promotion to more specialized and responsible positions.

Employment Outlook

The demand for professionally trained nurses continues to be high—as it has been since the beginning of World War II. Spokesmen for the principal nursing organizations estimated that about 70,000 additional nurses were needed in 1956. This shortage prevailed despite the fact that employment of nurses was at an all-time high and the 1940 ratio of 216 nurses per 100,000 population had increased to 268 in 1958. Principal factors which have helped to create the rising demand for nurses are: The improved economic status of the population, the widespread participation in hospital and medical insurance plans, the expansion in medical services resulting from new medical techniques and drugs, the increased interest in prevention of illness and rehabilitation of the handicapped, and the increased proportions of young and old persons in the population.

In addition to the need for nurses to fill new positions, many job vacancies stem from replacement requirements. It has been estimated that about 5 percent of all professional nurses leave the field each year, primarily because of marriage or family responsibilities. At present, not enough students are entering the nursing field to satisfy growth and replacement needs. The 42,014 student admissions in 1957–58 filled schools of nursing to about 90 percent capacity. But of those who enter nursing schools, about one-third usually drop out before graduation. During the school year 1957–58, a total of 30,410 nurses were graduated from basic training programs. In addition, 2,072 graduate nurses obtained a bachelor's degree and 997 a master's degree. If 4 percent of college-age girls continue to choose a nursing career, it has been estimated that by 1965 the number admitted to nursing schools will approximate 70,000 and the number of graduates, almost 40,000. The anticipated demand for these nurses is based on the continuing effect of the factors which have produced the present shortage and on our rising population, as well as congressional extension in 1958 of funds for hospital construction.

In the forecast of excellent job opportunities for professional nurses—prevailing both in the 1960's and over the long run—emphasis is placed on the need for well-qualified nurses, particularly those with graduate preparation in education and administration. A special conference called in 1958 by the U.S. Department of Health, Education, and Welfare for leaders in the nursing field reported that 58,850 teachers, administrators, and supervisors would be needed in 1959. Factors underlying the rising demand for well-trained nursing specialists are the rapid advances in medical drugs, techniques, and equipment; the need for more supervisors and administrators to utilize the assistance of auxiliary personnel in providing satisfactory nursing services; and the establishment of additional faculty positions in new or expanding programs for training professional and practical nurses. The associate degree programs, which have a high ratio of teachers to students, further increase the demand for nurse educators. Net effect of these developments is that employment opportunities can be expected to be good for all professional nurses but advancement possibilities will favor those with college training.

Earnings and Working Conditions

Minimum starting salaries of general duty nurses employed by hospitals in 16 metropolitan areas approximated from $55 to $70 a week in 1956–57, according to the Bureau of Labor Statistics. These earnings, received in most instances for 40 hours of work per week, may have been raised since then in some areas. Weekly salaries of general duty nurses (including both beginning and experienced nurses) were generally between $60 and $80 during the same period. In comparison to general duty nurses, head nurses averaged about 10 to 15 percent more and supervisors of nurses and nursing instructors, about 20 to 30 percent more. Government hospitals usually paid higher salaries than private hospitals in the same area.

Private duty nurses in most States earned from $14 to $16 for a basic 8-hour day in 1957, according to the American Nurses' Association. Average salaries of local public health nurses in 1958 were $4,301 in official (public) agencies and $3,881 in nonofficial (private) agencies. At the same time, staff nurses employed by boards of education averaged $4,854 a year. By region, salaries were highest in the West, next highest in the Midwest and North Atlantic States, and lowest in the South. Office nurses, when surveyed in June 1958, earned $3,600 a year on the average.

Occupational health (industrial) nurses averaged from $76.50 a week in Boston to $93.50 in Los Angeles–Long Beach in 19 metropolitan areas surveyed by the Bureau of Labor Statistics in late 1957 and early 1958. Earnings of these nurses had increased about 2 to 7 percent between 1955–56 and 1956–57 and about 3 to 7 percent more by 1957–58. An American Nurses' Association survey of nursing education programs indicated that nurse educators and administrators had a median salary of $4,140 in 1956. The median was $3,960 for teachers in hospital schools and $4,600 for teachers in collegiate schools.

Starting salaries of professional nurses with a bachelor's degree varied with their age and previous nursing experience, according to a survey of June 1957 women college graduates conducted by the U.S. Department of Labor's Women's Bureau in cooperation with the National Vocational Guidance Association. Annual salaries of baccalaureate degree nurses 22 years of age or under (presumably on their first nursing job) averaged $3,543 in the winter of 1957–58. Nurses 23 years of age or over (many of whom had previous nursing experience) averaged $4,057 a year. By comparison, the average starting salary was $3,739 for all women graduates surveyed (71 percent of whom were 22 years of age or under).

In the Federal civil service in 1958, the entrance rate for professional nurses was $4,040 for graduates of a 3-year school or for graduates of a 2-year school with 1 year of experience. Almost half of all Federal Government nurses earned from $4,490 to $5,390 a year, and salaries ranged as high as $12,555 a year for nursing administrators. For nurses with 1 year of graduate training and 1 year of experience in public health nursing, the Federal starting salary was $4,980; the majority of public health nurses earned salaries ranging from this amount to $6,885 a year. Beginning salary in 1958 for nurse officers (second lieutenants and ensigns) in military service and also in the commissioned corps of the U.S. Public Health Service was $4,063 (including rental and subsistence payments).

Virtually all nurses receive extra pay for work on evening or night shifts and at least 2 weeks of paid vacation after 1 year of service. Most hospital nurses in metropolitan areas receive from 5 to 11 paid holidays a year and also some form of health and retirement benefit.

Where To Go for More Information

Further information about professional nursing as a career is available in a publication of the U.S. Department of Labor, Women's Bureau on The Outlook for Women in Professional Nursing Occupations. Bulletin No. 203-3, Revised 80 pp. Washington, D.C., 1953. Price 30 cents.

Information on nursing education, approved schools of nursing, Future Nurse Clubs, and available scholarships may be obtained from:

National League for Nursing, Committee on Careers,
10 Columbus Circle, New York 19, N.Y.

Information on salaries, working conditions, and employment opportunities may be obtained from:

American Nurses' Association,
10 Columbus Circle, New York 19, N.Y.

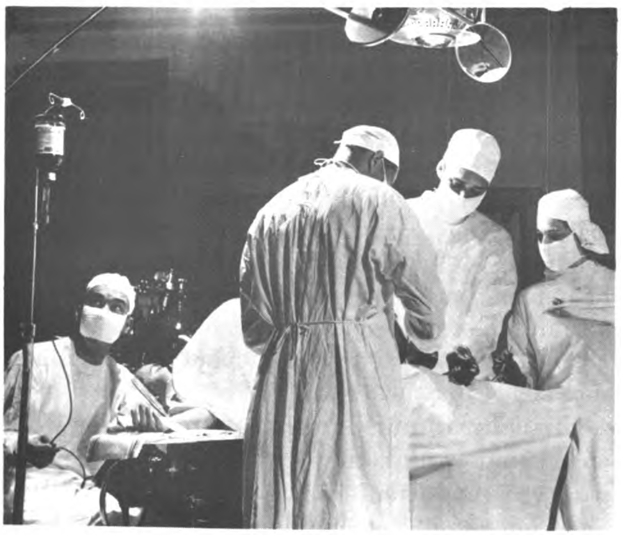
Physicians

(D.O.T. 0-26.10)

Nature of Work

Physicians diagnose diseases and treat people who are ill or in poor health. In addition, they are concerned with the prevention of disease and the rehabilitation of the injured or ill. They generally examine and treat patients in their own offices and in hospitals, but also visit patients at home when necessary. Some physicians combine the practice of medicine with research or college teaching. Others hold full-time research or teaching positions, or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

About half the physicians engaged in private practice are general practitioners—often referred to as "family doctors"; the others are specialists in one of the 32 fields recognized by the medical profession. In recent years, there has been a marked trend toward specialization. Among the largest specialties are surgery, internal medicine, pediatrics (medical care of children), pathology (diagnosing changes in body tissues), obstetrics (childbirth), gynecology (women's diseases), psychiatry (diseases and disorders of the mind), radiology (use of X-ray, radium, and other radioactive sources), ophthalmology (the eye and its diseases), and otolaryngology (diseases of the ear, nose, and throat).



Surgeon performing an operation with the aid of other medical workers.

Where Employed

About 216,000 physicians were professionally active in the United States in mid-1957. The great majority—about 157,000—were engaged in private practice. Approximately 24,000 were interns or residents in hospitals, and another 17,000 held regular positions on hospital staffs. About 10,000 physicians were serving as commissioned officers in the Armed Forces, and more than 6,000 were employed in Federal Government agencies, chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service. The remainder were employed in private industry, State and local health departments, medical schools, research foundations, and professional organizations.

In 1958, more than 40 percent of all physicians were in the five States with the largest population: New York, California, Pennsylvania, Illinois, and Ohio. In general, States in the northeastern part of the country had the highest ratio of physicians to population and the Southern States had the lowest. As a rule, general practitioners are much more widely distributed geographically than specialists, who are chiefly concentrated in big cities.

Training and Other Requirements

A license to practice medicine is required in all States and the District of Columbia. To qualify for a license, a candidate must graduate from an approved medical school, pass a licensing examination, and—in 32 States and the District of Columbia—serve a 1-year hospital internship. (Although 17 States still permit a physician to be licensed immediately upon graduation from medical school, it is universally recognized that an internship is necessary for acceptance by the profession, regardless of specific State requirements.) Twenty-one States and the District of Columbia specify that applicants for medical licenses must first pass an examination in the basic sciences to become eligible for the medical licensing examination.

Licensing examinations are given by State boards. The National Board of Medical Examiners also gives an examination which is accepted as a substitute for State examinations by most States. Although physicians licensed in one State can usually obtain a license to practice in another without further examination, some States limit this reciprocity.

At least 8 years of training beyond high school is needed to become a physician—3 years of premedical college study, 4 years of professional education in a medical school, and 1 year as a hospital intern. Some medical schools require applicants to have completed 4 years of college education. Premedical study must be in an approved college and must include courses in English, physics, biology, and inorganic and organic chemistry. In addition, students are encouraged to acquire a broad general education by taking courses in the humanities and the social sciences.

In 1958, there were 85 accredited schools in which students could begin the study of medicine. Eighty-two of these schools were fully approved —78 awarded the degree of doctor of medicine (M.D.) to students completing the 4-year course of study; 4 offered 2-year courses in the basic sciences to students who could then transfer to a regular medical school for the last 2 years of study. The three remaining schools (set up as 4-year institutions) had not yet graduated their first class and were, therefore, only provisionally approved.

The first 2 years of medical training are devoted to laboratory and classroom work in basic medical sciences, such as anatomy, biochemistry, physiology, pharmacology, microanatomy, and pathology. During the last 2 years, the student spends most of his time working in hospitals and clinics under the supervision of an experienced physician and learns to take case histories, perform examinations, and recognize diseases. Following completion of the 4-year medical course, all students serve at least a 1-year internship in a hospital.

To an increasing extent, young physicians are taking further training beyond the 1-year internship. Those who plan to enter general practice often serve an additional year as interns or residents in a hospital. To become recognized as a specialist, a physician must pass specialty board examinations. To qualify for these examinations, he must have spent from 2 to 4 years—depending on the specialty—in advanced hospital training as a resident, followed by 2 or more years of practice in the specialty. Doctors interested in teaching and research may take graduate work leading to the master's or Ph. D. degree in a field such as biochemistry or microbiology.

Every year, more young people apply to medical schools than can be admitted. Despite the expansion of training facilities, almost twice as many students applied for admission in 1957 as could be accepted. Nevertheless, medical schools reported a need for a greater number of highly qualified candidates. In selecting students, each medical school establishes its own standards. As a rule, considerable importance is attached to a good scholastic record; to the amount of premedical education (nearly 80 percent of the students entering medical school in 1957 had completed 4 years of college); to the standing of the college where this premedical work was taken; and to the score earned on the Medical College Admission Test, which is taken by almost all applicants. Consideration is given also to the applicant's character, personality, and leadership qualities, as evidenced in personal interviews and by extracurricular activities in college. In addition, many State-supported medical schools give preference to residents of their particular States.

A number of United States citizens—about 2,000 in 1957—study medicine abroad. In order to increase their choice of opportunities for appointment to internships or residencies in U.S. hospitals, graduates of foreign medical schools (citizens of foreign countries as well as U.S. citizens) should take the American Medical Qualification Examination given by the Educational Council for Foreign Medical Graduates. It is likely that, beginning July 1, 1960, all new graduates of foreign medical schools will have to be certified by the Educational Council before they are eligible for appointment as interns or residents.

Personal qualifications needed for success in this field include a strong desire to become a doctor, above-average intelligence, and an interest in science. In addition, the prospective physician should possess good judgment, the ability to make decisions in emergency situations, and emotional stability. Although some aspects of the physician's practice may appear to be glamorous or dramatic, it should be borne in mind that much of his professional experience also involves dealing with human tragedy.

The majority of newly qualified physicians open their own offices. New graduates entering the Armed Forces are usually commissioned as first lieutenants or lieutenants (j.g.) and, if they make military service a career, can rise to the higher ranks. Graduates of approved medical schools are eligible for Federal Civil Service positions and for commissions in the U.S. Public Health Service.

Employment Outlook

Opportunities for physicians are expected to continue to be excellent in the early 1960's despite an anticipated increase in the supply of new practitioners. Many medical schools have recently expanded their facilities and a few new schools are in the early stages of operation. The annual number of graduates is expected to rise from about 6,900 in 1958 to more than 7,400 by 1965. Moreover, graduates of foreign medical schools may continue to add to the supply—in 1957, over 1,500 foreign-trained physicians were licensed in the United States. However, about 4,500 new doctors will be needed to replace the physicians who retire or die each year. The rest will be needed to keep pace with rising demands for medical services.

The country's expanding population, the rising health consciousness of the general public, and the trend toward higher standards of medical care point toward a steady increase in the demand for physicians over the long run. Extension of prepayment plans for medical care and hospitalization, continued Government provision of medical care for veterans and for members of the Armed Forces and their families, and the continuing growth in the fields of public health, rehabilitation, industrial medicine, and mental health will bring about a need for more doctors. Expanded medical research activities will require more trained investigators; medical schools will have openings for additional faculty members; and the growing number of hospital training programs will require more interns and resident physicians.

The rising demand for physicians' services will be offset to some extent by advances in medical science and more efficient use of medical personnel. The introduction of new drugs and medical techniques, the more extensive use of assistants trained in other health occupations, and the increasing proportion of patients treated in hospitals rather than at home will probably enable individual physicians to care for more patients. Improved roads and transportation facilities as well as the movement of people from farms to urban areas will continue to decrease the time needed to visit patients. In addition, the growing tendency of doctors to work together in groups is expected to result in a more effective use of the physician's time. Nevertheless, population expansion and the general rise in use of medical services are expected to outweigh any lessening in demand arising from other developments. For all these reasons, the outlook over the long run is very bright for young people who have proper qualifications and are able to gain admittance to medical school.

Women physicians, who constitute about 6 percent of the profession, will continue to find good opportunities as general practitioners and as specialists in pediatrics, psychiatry, obstetrics, gynecology, internal medicine, and anesthesiology. In 1958, almost 6 percent of all medical school students were women. Only two schools had no women in the freshman class; one school accepted only women students.

Earnings and Working Conditions

New graduates serving as interns in 1957 earned, on the average, $155 a month in hospitals affiliated with medical schools and $197 a month in other hospitals. In many cases, interns also received room, board, and other maintenance. During the first year or two of independent practice, physicians may earn little more than the minimum needed to pay expenses but, as a rule, their earnings rise rapidly as their practice develops.

According to a survey made by a private organization in mid-1955, the average (median) income above business expenses of family physicians was approximately $15,000. About one-fifth of the family physicians had net incomes of less than $10,000; nearly half netted between $10,000 and $20,000; and one-third netted $20,000 or more.

In general, earnings of individual physicians depend on such factors as size of community and region of the country in which the practice is located, the income level of the people cared for, and the physician's skill and personality as well as length of experience. As a rule, physicians engaged in private practice earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners.

Many physicians work long and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they tend to work shorter hours. Many, however, continue in practice well beyond 70 years of age.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Lists of approved premedical and medical schools, as well as general information on medicine as a career, may be obtained from:

Council on Medical Education and Hospitals, American Medical Association,
535 North Dearborn St., Chicago 10, Ill.

Association of American Medical Colleges,
2530 Ridge Ave., Evanston, Ill.

Pharmacists

(D.O.T. 0–25.10)

Nature of Work

Pharmacists' duties include filling prescriptions ordered by physicians and other medical practitioners and storing and distributing medicines and drugs, including narcotics. They also advise doctors and others on the uses and availability of drugs. Pharmacists must understand the composition, manufacture, action, and effect of drugs and be able to test them for purity and strength. However, compounding—the actual mixing of ingredients to form powders, pills, capsules, ointments, and solutions—is only a small part of present-day pharmacists' work. Nowadays, many drugs are produced by manufacturers in the form used by the patient.

The amount of time pharmacists spend performing strictly professional duties depends on their place of employment. The work of many pharmacists in retail drug stores involves a combination of professional, sales, and managerial functions. Besides dispensing drugs, these pharmacists may hire and supervise salesclerks, arrange window displays, and purchase and sell merchandise unrelated to drugs. Some retail pharmacists, however, operate prescription pharmacies which handle only drugs and medical supplies. Pharmacists in hospitals fill prescriptions and advise the medical staff on the selection and effects of drugs; they may also manufacture sterile solutions, purchase medical supplies, teach in schools of nursing, and perform administrative duties. Some pharmacists employed as medical-service representatives (detail men) by drug manufacturers and wholesalers inform doctors about new drugs and sell medicines to other pharmacists. Others teach in colleges, perform research, supervise the manufacture of pharmaceuticals, develop new drugs, write for pharmaceutical journals, or do administrative work.

Pharmacist measuring ingredients called for by a doctor's prescription.

Where Employed

About 101,000 of the 112,000 registered pharmacists in the United States in early 1958 worked in drugstores. Half of these 101,000 pharmacists owned their drugstores, alone or as members of a partnership; the other half were salaried employees with no financial interest in the pharmacies in which they worked. Of the remaining 11,000 pharmacists, the greatest number were employed by drug manufacturers and wholesalers and the next largest number worked for hospitals. Approximately 600 were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. In addition, some served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for other employers such as State and local government agencies.

Nearly every small town has at least one drugstore with one or more pharmacists in attendance, but most members of the profession tend to be concentrated in or near big cities. About 40 percent of the Nation's pharmacists are in New York, Pennsylvania, California, Illinois, and Ohio.

Training and Other Qualifications

A license to practice pharmacy is required in all States and the District of Columbia. An applicant must be a graduate of an accredited pharmacy college, pass a State Board examination and, in most States, must also have 1 year of practical experience under the supervision of a registered pharmacist. In 11 States, part or all of this experience must be acquired after graduation. All States except New York, California, and Florida will grant a license without an examination to properly qualified pharmacists already licensed by another State.

In 1958, there were 75 accredited pharmacy colleges in the United States. Many of these were not filled to capacity and qualified applicants could usually expect to be accepted. It takes at least 4 years of study beyond high school to graduate from a pharmacy college, and a longer period of training is required by several schools. Pharmacy colleges with a 4- or 5-year course admit students directly from high school and provide all the education necessary for graduation. Other pharmacy schools provide only 3 years of professional instruction and require all entrants to have completed 1 or 2 years of prepharmacy training in an accredited college. Prepharmacy training usually emphasizes mathematics and basic sciences, such as chemistry and biology, but includes courses in the humanities and social sciences. Beginning in April 1965, each accredited pharmacy college will issue degrees only to those with 5 years of college education, including at least 3 years in an accredited pharmacy school. The first students affected by this requirement will be those who start their college training in 1960.

The bachelor's degree awarded upon graduation from a pharmacy college is sufficient educational qualification for most positions in the profession. However, the master's or Ph. D. degree in pharmacy or a related field, such as pharmaceutical chemistry, pharmacology, pharmacognosy, or pharmacy administration, is usually required for research work or college teaching. Graduate training is also considered desirable for pharmacists planning to work in hospitals. Those interested in becoming hospital pharmacists can sometimes secure 1- or 2-year internships which combine graduate study and practical hospital pharmacy experience.

Prospective pharmacy students should have a good high school background in mathematics and science. In addition, orderliness and a liking for detail are desirable qualities for young people entering the profession. For those planning to become retail pharmacists, the ability to deal with people and manage a business is of special importance.

Most pharmacists begin as employees in retail drugstores. After obtaining some experience, those with sufficient funds may open their own pharmacies or buy established drugstores. A pharmacist who gains experience in a chain drugstore may advance to store manager and, later, to a higher executive position within the company.

Employment Outlook

Most new pharmacy graduates are expected to find employment readily in the early 1960's. From 3,000 to 4,000 openings will arise each year as pharmacists retire, die, or transfer out of the profession. These openings, together with the anticipated gradual increase in new positions for pharmacists, are expected to provide enough jobs to absorb each year's graduates. Although employers will generally be able to meet their needs for pharmacists with the bachelor's degree, not enough people with graduate training in pharmacy and related fields are likely to be available for college teaching and laboratory research positions.

In the long run, a moderate but steady increase in employment of pharmacists is expected. The country's expanding population—especially the growing number of old people and children—and the rising standard of medical care point to an ever-increasing demand for pharmacists' services. The trend toward bigger drugstores is expected to continue, and some new stores will be added, particularly in new residential areas or suburban shopping centers. Also, in view of the trend toward shorter working hours, many drugstores will hire additional pharmacists. Continued expansion in pharmaceutical manufacturing and research is expected to provide more opportunities for pharmacists not only in production and research but also in distribution and sales positions. Employment in hospitals will probably rise significantly with the construction of additional facilities and the more extensive use of pharmacists for hospital work. In both the drug industry and hospitals, the demand will be greatest for pharmacists with graduate training.

Thus, many factors point toward continuous growth in this profession. It should be borne in mind, however, that employment of pharmacists is closely related to the prosperity of the retail drug industry which, in turn, depends on the general level of economic activity.

Women, who represent about 7 percent of all pharmacists, will continue to find their best opportunities in hospital pharmacies, prescription pharmacies, and in laboratory work, although some are employed in all branches of the profession. Women students are accepted by all colleges of pharmacy and, in 1958, constituted 12 percent of undergraduate enrollments.

Earnings and Working Conditions

Beginning pharmacists employed in drugstores earned about $125 a week in 1958, according to reports from cities in various parts of the country. Pharmacists who owned and operated drugstores generally made more than this; however, their earnings, and also to a lesser extent those of salaried pharmacists, are greatly affected by the length of their workweek, the size and geographic location of the store, and many other factors. Beginning pharmacists employed in hospitals and drug manufacturing firms generally earned from $4,500 to $6,000 a year. The usual entrance salary for pharmacists in the Federal Civil Service was $4,980 in early 1959.

Retail pharmacists generally work more than the standard 40-hour week. Drugstores are often open in the evenings and on weekends and all States require a registered pharmacist to be in attendance at all times. Despite the trend toward shorter hours, 45 or 48 hours is still often the basic week for salaried retail pharmacists and many work 50 or more hours a week. Self-employed pharmacists often work more hours than those in salaried positions. Those who teach or work for industry, Government agencies, or hospitals have shorter workweeks.

Where To Go for More Information

Current requirements for licensure in a particular State may be obtained from the Board of Pharmacy at the State capital.

Information on pharmacy as a career may be obtained from:

American Pharmaceutical Association,
2215 Constitution Ave. NW., Washington 7, D.C.

Information on entrance requirements, curriculums, and scholarships is available from the dean of any college of pharmacy. A list of accredited colleges may be obtained from:

American Council on Pharmaceutical Education,
77 West Washington St., Chicago 2, Ill.

Dentists

(D.O.T. 0–13.10)

Nature of Work

Dentists locate and fill cavities in the teeth, straighten crooked teeth, take X-rays of the mouth, and treat gum diseases. Dentists also extract teeth and substitute artificial dentures especially designed to meet the needs of each patient. In addition, they clean teeth and examine the mouth for diseases which may affect a patient's general health. Dentists spend most of their time taking care of patients, but they also may devote some time to laboratory work which includes making dentures, inlays, and other dental appliances. Many dentists, however—particularly those in large cities—send most of their laboratory work to commercial firms. Some dentists also employ dental hygienists who clean the patient's teeth.

Most dentists provide all types of dental care and are regarded as general practitioners; only about 4 percent are recognized as specialists. Approximately half the specialists are orthodontists, who straighten crooked teeth. The next largest number, oral surgeons, perform operations on the mouth and jaws. The remainder specialize in periodontology (treating the tissues supporting the teeth), prosthodontics (making artificial teeth or dentures), pedodontics (children's dentistry), oral pathology (diseases of the mouth), and public health dentistry.

Only 3 out of every 100 dentists are primarily employed in teaching, research, or other work that does not involve "chairside" practice. However, many dentists in private practice teach or engage in research on a part-time basis.

Where Employed

Ninety percent of the 91,000 dentists professionally active in mid-1958 were in private practice. Of the remainder, about 6,000 served as commissioned officers in the Armed Forces; 1,200 worked for the Federal Government—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service; and about 1,800 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists constituted only about 2 percent of the profession.

Most dentists are located in big cities. They are also concentrated in a few States to a greater

Dentist using X-ray pictures to explain dental problems to a patient.

extent than the population in general. In 1957, 4 States (New York, California, Pennsylvania, and Illinois) had almost 40 percent of the dentists whereas 21 States had only 10 percent. The region including Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, and West Virginia had the highest ratio of dentists to population, with 1 dentist for every 1,434 persons in 1957. New England had the second highest ratio and the Far West, the third. At the other extreme was the Southeast with an average of only 1 dentist for every 2,988 residents in 1957.

Training and Other Qualifications

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license, a candidate must be a graduate of an approved dental school and pass a State Board examination. One State, Delaware, also requires new graduates to serve 1 year of hospital internship. Most State licenses permit dentists to engage in both general and specialized practice. In nine States, however, a dentist cannot call himself a "specialist" unless he has been licensed as such after passing a special State examination.

In planning a career in dentistry, the student should obtain information on requirements for licensure in the State in which he hopes to practice. Educational and other requirements differ somewhat among the States. Even though a dentist holds a license in another State, few States issue a license without further examination.

Two years of predental college work followed by 4 years of professional training in a dental school are the minimum educational qualifications for dentistry; 7 of the 46 dental schools in operation in the United States in 1958 required 3 years of predental study. Predental education must include at least one half-year course in organic chemistry and a full-year course in each of the following: English, biology, physics, and inorganic chemistry.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in such basic sciences as anatomy, bacteriology, and pharmacology. The last 2 years are spent chiefly in gaining experience with patients in the school's dental clinic. The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges; the degree of Doctor of Dental Medicine (D.D.M.) is conferred by a few schools.

Dentists interested in research or teaching often take graduate work in a basic science. To become recognized as a certified specialist, a dentist must pass specialty board examinations. To qualify for these examinations, he needs 2 or 3 years of graduate education and several years of specialized experience. Graduate training may be obtained at graduate schools of dentistry and also by serving an internship or residency at 1 of the 207 approved hospitals which offer these programs.

Considerable competition exists for admittance to dental schools. Despite the recent opening of several new dental colleges, twice as many students applied as could be admitted to the freshman class in 1957. In selecting students, dental schools give considerable weight to college grades and amount of college education; over 75 percent of the students enrolled in 1957 had at least 3 years of college education and more than 40 percent had bachelor's degrees. In addition, all dental schools participate in a nationwide dental aptitude testing program, and scores earned on these tests are taken into consideration along with other information gathered about the applicant through recommendations or interviews. Many State-supported dental schools also give preference to residents of their particular States.

The profession of dentistry requires both manual skills and a high level of intelligence. The dentist should have a good visual memory, excellent judgment of space and shape, delicacy of touch, and a high degree of manual dexterity, as well as the ability to master scientific subjects. A liking for people and a good business sense are helpful in achieving success as a practitioner.

The majority of newly qualified dentists open their own offices or purchase established practices. Some start in practice with dentists who are already established in order to gain experience and to save the money required to equip an office; others may enter residency or internship training programs in an approved hospital. Dentists entering the Armed Forces are commis-

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sioned as first lieutenants or lieutenants (j.g.) and may progress to higher ranks. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions in the U.S. Public Health Service.

Employment Outlook

The demand for dental services is likely to increase faster in the early 1960's than the supply of new dentists. Although the number of dentists graduated each year is expected to increase from about 3,100 in 1958 to an estimated 3,700 by 1965, about two-thirds of these new graduates will be needed to replace those who retire or die. To keep pace with anticipated population expansion, many more graduates will be needed each year. These additional dentists cannot be trained unless there is a greater increase in dental school facilities than was contemplated in 1958.

A steady increase in the demand for dental services is expected over the long run. Growing awareness of the importance of obtaining regular dental care and the trend toward budget payment and dental prepayment health plans, as well as the growth in population, will cause a continuing rise in the demand for practitioners. Expanded dental research activities will require more trained personnel; dental public health programs will need qualified administrators; and dental colleges will have openings for additional faculty members. A number of dentists will continue to serve in the Armed Forces. Although better dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, such measures—by preserving teeth that might otherwise be extracted—may tend to increase rather than decrease the demand for dental care over the long run.

The introduction of new techniques, equipment, and drugs as well as more extensive and effective use of dental hygienists, assistants, and laboratory technicians will probably enable individual dentists to care for more patients. Nevertheless, population growth and the huge backlog of unmet dental needs, coupled with the increasing use of dental services, will more than offset developments which might decrease the need for dentists.

Location is one of the major factors in determining success of dentists who open their own offices. For example, people who are well educated and well paid are most likely to visit dentists regularly. Also, a practice can be developed most quickly in small towns where the new dentist can easily become known and where there is less competition with established practitioners. The income from practice in small towns, however, may eventually be less than that in larger communities. The dentist planning to open an office should, therefore, choose his location carefully and consider the number of other dentists in the area, as well as the size, income, and educational level of the population.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to pay expenses, but their earnings rise rapidly as their practice develops. In 1955, the average income above expenses for all self-employed dentists was about $12,500 a year, compared with $9,300 for all salaried dentists, according to an American Dental Association survey. Approximately 60 percent of all dentists earned between $7,000 and $17,000 annually; 20 percent earned less than $7,000; and 20 percent earned more than $17,000. Two percent of all dentists reported incomes of $30,000 or more. Specialists generally earned considerably more than general practitioners, with orthodontists reporting the highest average incomes.

Dentists in the Far West and South had higher average incomes than those in other regions of the country. Dentists' incomes tended to be lowest in New England and the Middle Atlantic States. Practitioners in medium-size cities (50,000 to 500,000 population) earned more, on the average, than those in either larger or smaller cities.

Most dental offices are open 5 days a week and some dentists have evening hours. Although dentists averaged about 43 hours' work a week, almost one-fourth of those surveyed in 1955 reported they spent 50 or more hours a week in the office. Many dentists work fewer hours as they grow older, since the hours of work are usually determined by the dentist himself. For this reason, a considerable number continue in part-time practice beyond 65 years of age.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, may be obtained from:

American Dental Association, Council on Dental Education,
222 East Superior St., Chicago 11, Ill.

Medical X-Ray Technicians*

(D.O.T. 0–50.04)

Nature of Work

Medical X-ray technicians operate several types of X-ray equipment that make visible on film internal parts of the body which the physician wishes to examine. X-ray machines are used to detect the presence of foreign matter or injury and to discover malformation or malfunctioning of various parts of the human body. In addition, they may be used for the treatment of certain diseases, including various cancers and tissue infections. The detection of disease or injury by means of X-ray is called "diagnostic" X-ray, and treatment by X-ray is called "therapeutic" X-ray.

Medical X-ray technicians work under the direction of a radiologist, who is a physician specializing in the use of X-rays, or under some other doctor of medicine. To prepare for an X-ray, technicians position the patient between the X-ray tube and the film and apply a protective lead plate to body areas which are not to be exposed to the rays. Where necessary, they set up or adjust devices which prevent movement by the patient. In taking X-rays (radiographs), technicians determine the proper voltage, current, and exposure time and regulate the controls for obtaining films of high technical quality for interpretation by the physician. Because they are partly responsible for the care and safety of patients undergoing radiation, technicians must adjust and manipulate the equipment in such a way as to minimize hazards of burns and scattered radiation. They are also required to clean their equipment and make minor repairs.

Technicians may assist a physician in fluoroscopy or other special types of X-ray work by preparing a prescribed X-ray "opaque," such as barium salts, which the patient swallows in order to shade various parts of the anatomy to give proper visibility for X-ray purposes. The actual fluoroscopic process, however, is conducted by the physician. In assisting in therapeutic work with X-rays, radium, or cobalt (treating diseased and affected areas of the body by exposure to X-ray or radioactive metals), the technicians work under the direct supervision of a radiologist. Chief technicians, also under the direction of a radiologist, may instruct interns, nurses, and students in X-ray technique.

Some X-ray technicians working in small hospitals may learn on the job to operate other kinds of apparatus, in addition to those related to radiological work. Equipment for diagnosing heart disease or brain damage and that for de-

COURTESY OF NATIONAL INSTITUTES OF HEALTH

X-ray technician assisting radiologist during a special radiographic procedure.

*Prepared by the Women's Bureau, U.S. Department of Labor.

termining basal metabolism, for example, are among those most commonly found in combination with the operation of X-ray apparatus.

Additional duties of technicians working in a physician's office or small laboratory may consist of processing X-ray film and keeping records of services performed for each patient, but in larger institutions such tasks are usually assigned to a darkroom assistant or clerk.

A few X-ray technicians, called radioisotope technicians, work in the new and expanding field of atomic medicine. Persons with background other than X-ray, such as laboratory technicians, have also been entering this field. These technicians help scientists conduct certain experiments with the specially treated chemical elements that trace the course of a food or chemical through the body. The radioactive isotopes (atoms that give off radiation) are also used to help physicians diagnose and treat certain diseases.

Although the duties of radioisotope technicians have not yet been clearly defined, they generally involve preparing dilutions of radioactive material according to a prescribed formula, operating the several types of equipment used to perform the different tests and measurements, and making the necessary calculations. Great care must be taken to prevent excessive exposure to the radioactive material. These technicians may also help design or adapt apparatus and develop techniques.

In 1958, more than 60,000 persons were employed as medical X-ray technicians, of whom more than 21,500 were registered with the American Registry of X-ray Technicians. These registered technicians are permitted to use the letters R.T. (ARXT) after their names, indicating that they have secured the prescribed training and experience and passed the required examination. Women comprised about 70 percent of these registered technicians in 1958 and, probably, were a majority of all medical X-ray technicians.

Where Employed

About a fourth of all medical X-ray technicians were employed in hospitals in 1958. The remainder worked in medical and research laboratories, physicians' offices and clinics, public health facilities, companies' employee-health programs, and military establishments. Most technicians work in large cities where medical facilities and services are largely concentrated; however, some will be found in smaller areas with only one hospital or other medical facility. In addition, the widespread use of the X-ray for routine medical examinations in various health, welfare, and industrial programs of preventive medicine has brought about the establishment of small mobile X-ray teams.

Training, Other Qualifications, and Advancement

The most widely known and accepted training courses for X-ray technicians are those offered by medical and hospital schools approved by the Council of Medical Education and Hospitals of the American Medical Association. Of the 517 approved schools in operation at the end of 1957, slightly more than half offered a 24-month training program. Courses in the remaining schools varied from 1 to 2 years; in four of these remaining schools, a 36-month curriculum was available. A high school education was the general prerequisite for entrance. However, some schools (22) required more than a high school education for entrance; a few schools required that applicants have as much as 2 years of college credits or that they be registered nurses. Preference was generally given to applicants between the ages of 18 and 35 who were graduate nurses or had completed some nurse training or college science courses.

Some knowledge of physics, chemistry, algebra, geometry, and biology is considered helpful background for the technical course included in X-ray technology. The X-ray technician's curriculum generally includes courses in X-ray physics, anatomy and physiology, X-ray technique and positioning, and film processing (darkroom procedure). A number of schools are also including a course in X-ray therapy. The cost of training in approved hospital schools, aside from maintenance expenses, is relatively low. Almost two-thirds of these schools charged no tuition in 1958, and most of the remainder charged modest tuition fees ranging up to $150 for the complete program. A few were more expensive, and some charged the regular fees of the affiliated university. A majority of the schools paid their students some sort of stipend.

Formal training in radioisotope techniques has thus far been limited to a few institutions throughout the country. The Oak Ridge Institute of Nuclear Studies also offers both basic and advanced specialized courses, and the Armed Forces provide isotope training programs for nurses and military personnel. Much of the instruction, however, has been made available only "on the job" in radioisotope departments of hospitals and research centers.

Besides the approved hospital courses, one can learn to operate X-ray equipment through training offered on the job, or through private schools of medical and X-ray technology. Those who receive only partial training or a minimum of clinical practice, however, may have difficulty in qualifying for X-ray jobs with a wide range of assignments or responsibility.

To meet minimum requirements for registration with the American Registry of X-Ray Technicians, technicians must have had a high school education or its equivalent and either 2 years of training and experience under the direction of a recognized radiologist, or 1 year under a recognized radiologist plus 2 additional years of X-ray experience under the direction of a doctor of medicine who uses X-ray equipment though he does not specialize in radiology. Technicians must also pass an examination given by the Registry. After July 1, 1960, only those with 2 years of training and experience under a radiologist's supervision will be eligible for examination and registration.

Since X-ray work is often performed on sick or helpless patients, the technician should be a sympathetic and patient person with a cheerful disposition and a keen sense of responsibility. In addition to exercising considerable independent judgment and initiative, the successful technician pays close attention to detail and is deft in manipulating machinery. Above-average spatial perceptiveness is also necessary.

Employment Outlook

A shortage of X-ray technicians was evident in 1958, especially in communities with small hospitals. The shortage was due, in large part, to the rising demand for technicians to staff rapidly expanding hospital and medical programs. Also, the expansion of public health programs and services and the growing interest in preventive medicine have increased the number of opportunities in government employment.

During the past 20 years, there has been considerable activity in the health field. Hospital facilities have been continually expanding; significant technological advances have occurred in the diagnosis and treatment of diseases and injuries; and the expanded use of X-ray equipment has been a part of this advance. Originally confined to bone diagnosis and locating foreign bodies, X-ray equipment is now used in such fields as tuberculosis detection, examination of teeth, and treatment of cancer and certain skin diseases. While other methods are beginning to replace X-rays, routine X-raying of large groups is still being performed as part of a program for disease prevention and control by health departments, tuberculosis hospitals, industrial establishments, and health associations in many parts of the country. Many insurance companies now include a chest X-ray as part of the physical examination required for an insurance policy. All of these developments contribute to a growing need for medical X-ray technicians.

The demand for X-ray technicians is expected to continue well into the 1960's. Many thousands of technicians will be needed to fill new positions. In addition, annual replacement needs will be relatively high because of the large number of women in the field, many of whom can be expected to leave for marriage and family reasons. The supply of well-trained personnel will probably be insufficient. As a result, many technicians will be trained on the job in a limited number of skills, and those with all-round abilities and experience will have very good employment opportunities. In order to supplement their full-time staff, employers will continue to offer part-time work. Mature persons with recognized training or experience also will have good job prospects.

Authorities in the field believe that, in general, technicians with a variety of skills and experience have the best opportunities for promotion. Those employed in large X-ray departments usually have the chance to qualify for the job of chief X-ray technician, or, perhaps, assistant to the chief. They also may be able to advance in their positions by qualifying to teach X-ray techniques to students in training. Since the number of such positions is fairly limited, however, versatility and ability to supervise or instruct others are very important skills for the career-minded.

Earnings and Working Conditions

Average salaries (excluding premium pay and value of meals or other supplements) of X-ray technicians working full time in hospitals in 1956–57 ranged from $59.00 to $82.50 a week for men and from $53.50 to $76.00 for women, according to a U.S. Department of Labor survey of 16 metropolitan areas. Corresponding earnings of chief technicians in 12 of these cities averaged from $83.00 to $106.00 a week for men and from $64.50 to $95.00 for women. Nine out of ten medical X-ray technicians in the Federal Civil Service in early 1957 were classified in positions that paid, in 1959, from $3,755 to $5,390 a year.

Full-time technicians generally work 8 hours a day, or 40 to 44 hours a week and may be "on call" for some night or emergency duty for which they receive equal time off or additional compensation. Most are covered by the vacation and sick leave provisions of the organizations which employ them, and some receive free medical care and private pension benefits.

Medical X-ray technicians work in sanitary surroundings, and great care is exercised to protect them from radiation exposure. Potential hazards are kept in check partly by frequent blood counts and attention to diet, fresh air, and sunshine; nevertheless, persons with a tendency toward anemia are usually advised to avoid this occupation. Other precautions that should be rigidly observed include the use of safety devices such as individual instruments that measure radiation (e.g., film badges and dosimeters), lead aprons, rubber gloves, and other shieldings.

The physically rigorous demands of continuous standing and lifting of equipment and nonambulatory patients call for persons of good health and stamina who can work speedily and accurately often under conditions of stress.

Where To Go for More Information

Additional information about medical X-ray technicians is given in the following publication: The Outlook for Women as Medical X-ray Technicians. Women's Bureau Bulletin 203–8, 1954. Superintendent of Documents, Washington 25, D.C. Price 25 cents.

Information, particularly on registration and approved hospital schools, may be obtained from:

The American Registry of X-Ray Technicians,
Metropolitan Building, Minneapolis 1, Minn.

The American Society of X-Ray Technicians,
16 14th St., Fond du Lac, Wis.

Medical Technologists*

(D.O.T. 0–50.01)

Nature of Work

Medical technologists are all-round laboratory workers who perform a variety of laboratory tests that assist physicians in the detection, diagnosis, and treatment of disease. In general, technologists make complex clinical examinations with a minimum of supervision. They are responsible to a doctor of medicine, usually a pathologist (a physician who specializes in the nature and causes of disease). However, they may work under the supervision of a medical scientist who is a specialist in a particular branch of clinical science, such as hematology, serology, biochemistry, or bacteriology. Other laboratory personnel, working as technicians, assistants, or aids, perform routine examinations or a limited number of tests to assist the medical scientist, technologist, or physician.

Technologists may take blood counts or type and cross-match blood, make urinalyses, collect other clinical samples, prepare vaccines and serums, give biological skin tests, measure basal metabolism, and analyze water, food products, or other materials for bacteria. They also calibrate instruments and equipment, standardize solutions, prepare tissue specimens for microscopic examination, cultivate and identify bacteria and observe their reactions to various antibiotics, prepare slides of cells for cancer testing, analyze stomach content and body fluids or other material,

*Prepared by the Women's Bureau, U.S. Department of Labor.

Medical technologist using microscope to examine slides for possible cancer cells.

and make many other measurements and analyses.

Technologists must recognize unusual conditions and make accurate findings based on correct observations. Theoretical knowledge and scientific competence are necessary for the solution of difficult problems and analyses. In a small laboratory especially, versatility is needed. In a large establishment, on the other hand, each technologist, although qualified to work in various fields of medical laboratory science, usually concentrates on only certain types of procedures. Most medical technologists conduct tests or studies in connection with examinations and treatment of patients; some do research on new drugs or on the improvement of laboratory techniques; and some perform administrative duties as technical head of a laboratory. Others teach or supervise technicians and helpers who either acquire all their instruction on the job or have only limited post-high-school training in science and laboratory techniques.

Where Employed

In 1958, some 26,000 medical technologists were registered with the Registry of Medical Technologists of the American Society of Clinical Pathologists (ASCP). This group, of course, did not account for all the employed technologists since some are not registered. Women comprised almost 90 percent of the registered medical technologists, but in recent years, an increasing number of men have been entering this comparatively new profession.

About two-thirds of all medical technologists work in hospital laboratories. The remainder work in laboratories of private physicians, public health departments, medical departments of industrial plants, clinics, or research institutions or in schools of medical technology, as instructors. Most technologists work in large metropolitan areas since this is where the largest medical facilities are located, but some will be found in less populated areas wherever a hospital or medical laboratory exists.

Training

The most widely recognized medical technologists are those designated as Medical Technologists (American Society of Clinical Pathologists)—M.T. (ASCP). This specific title may be used only by those persons who pass the examination for registration and certification given by the Registry of Medical Technologists of the American Society of Clinical Pathologists.

At present, the minimum training required for a Medical Technologist (ASCP) includes 2 years of accredited college work, with at least one-third of the credits taken in biology and chemistry, followed by 12 months of technical training in a school of medical technology recognized by the Council on Medical Education and Hospitals of the American Medical Association. Effective January 1962, the 2-year college prerequisite will be increased to 3 years, to include additional courses for broadening the student's science background and for meeting new standards for professional status as medical technologists. Because of this 4-year total of combined instruction, it is expected that a much larger number of medical technology schools will affiliate with universities in order to offer programs leading to a bachelor of science degree in medical technology.

The specialized curriculum for medical technologists includes the following subjects: biochemistry, hematology (blood analysis), bacteriology, parasitology, histologic technic (tissue preparation), serology (serum analysis), urinalysis, blood banking, basal metabolism, and miscellaneous clinical microscopy.

New developments are emerging in certain specialized fields of medical laboratory work in which the duties and training requirements are not yet clearly defined. For example, the relatively new technique in cancer detection (examination of castoff cells) will require a few thousand workers with specialized training in screening cell slides if current plans to make this test widely available are to be carried out. So far, the only formalized requirements are those established by the ASCP which offers a certificate in Exfoliative Cytology. By 1960, this certificate will require 2 years of college work, including a sufficient number of hours in biology and chemistry, plus at least 6 months of study in cytology and another 6 months of specialized training in a laboratory approved for such training. Another comparatively new branch of science is atomic medicine, in which the increasing need for radioisotope technicians is expected to lead to eventual formulation of standards for medical technologists who specialize in this field.

Separate certification by the ASCP Board of Registry is also being given to certain laboratory persons with specialized training: (a) those with a bachelor's degree and a major in either chemistry or bacteriology, as well as 1 year of laboratory experience in their respective field, are eligible for a certificate in chemistry or microbiology; and (b) a registered M.T. (ASCP) who has had 3 months of training in a blood bank approved for such training, plus 9 months of practical experience, may apply for a certificate in blood banking.

By mid-1958, nearly 700 schools offering instruction in medical technology had been approved by the Council on Medical Education and Hospitals of the American Medical Association. About four-fifths of the approved schools accepted applicants with 2 years of college; the remainder required more education for entrance. Length of training time ranged from 12 to 24 months, with 12-month courses offered by 9 out of 10 of the schools.

The cost of training, aside from maintenance expenses, was relatively low. No tuition was required by about four-fifths of the approved schools, and $100 for the complete course was the most common fee in the remainder. A small number of schools, which combined hospital training with a college degree program, charged the regular tuition of the affiliated university. Almost half of all approved schools offered stipends; and some organizations, such as the American Cancer Society and the National Cancer Institute, provided additional stipends or paid tuition costs for students. A few colleges offer a master's degree in medical technology, and courses in education and administration are beginning to be combined with advanced technical subjects in order to prepare medical technologists for teaching and administrative positions.

The increasing complexity of medical laboratory procedures, the advances in scientific knowledge, and the establishment of professional standards for medical technologists have all contributed to the necessity for more theory and clinical practice than that which is provided by most commercial schools of medical technology. Thus, many employers prefer or require that prospective staff members be registered, or eligible for registration, with the Registry of Medical Technologists of the ASCP. Still other hospitals and clinics are accepting only those with a college degree background. In the Federal service, for example, a professional series of positions for medical technologists was established in 1958 which requires that applicants for entry positions have a bachelor's degree in medical technology or a combination of equivalent training and experience, of which 3 years must include college instruction. Those with a bachelor of science degree in either chemistry or biology must have, in addition, 1 year of experience or training in medical laboratory work. To be eligible for advanced positions, additional professional experience is required as a medical technologist or medical specialist, such as biochemist or bacteriologist.

Thus, persons with only 1 or 2 years of training or experience and insufficient college background will find it increasingly difficult to obtain positions as medical technologists. Most of such persons will be limited to jobs as laboratory technicians or assistants.

Some States (Alabama, California, and Florida) require licensing for medical technologists as well as for other laboratory personnel. Licensing laws differ from State to State and may specify more or less extensive training or experience than that required in order to qualify as a M.T. (ASCP). Licenses are also issued in individual subjects (biochemistry, bacteriology, serology, and parasitology) if technologists have a master's degree or doctorate in one of these specialties plus a year of postgraduate laboratory experience in the special field.

Some of the important personal traits needed for medical laboratory work are extreme accuracy and patience, dependability, resourcefulness, manual dexterity, and the ability to follow directions and to remain calm under pressure and in the presence of patients. In addition to the desire to provide service to the sick by aiding in their diagnosis and recovery, technologists should have an interest in science since they are a vital part of the medical team. Good eyesight is a basic requirement, but many who are otherwise physically handicapped have proven highly satisfactory in their duties.

Advancement opportunities depend principally upon the size of the organization, the level and extensiveness of training and experience, and the professional abilities of the individual. In a large organization, a competent technologist may become a supervisor of a group of technicians and assistants, or perhaps chief technologist or technical head of the laboratory under the general direction of a pathologist. Increasing emphasis on research also affords the technologist possibilities for original investigation. Those interested in teaching may take advantage of growing opportunities developing in the training of new workers and as teaching supervisors. Thus, for thoroughly trained technologists, advancement is possible through supervision, administration, or specialization. Positions above these levels, however, are filled by pathologists or medical scientists with advanced degrees. Of course, the medical technologist, through specialized and additional college training, may become a medical scientist and advance to higher levels in one of these specialties.

Employment Outlook

A substantial shortage of medical laboratory technologists was evident in 1958 and is expected to continue into the 1960's. This need for additional technologists is due in part to the rapid expansion of hospital and medical programs and the growing number of government medical facilities and health services with their increased emphasis on health research. Advances in medical knowledge and practice are depending more and more upon laboratory work, and the increasing complexity of the tests coupled with ever-developing experimentation with new drugs and techniques have further pointed up the necessity for well-qualified personnel with college training. Although a continuing nationwide campaign to recruit young people into the profession is meeting with considerable success, the supply of technologists will undoubtedly be insufficient to fill staffing requirements owing in part to the limited possibilities of expanding training facilities.

Replacement needs account for additional job openings, since many of the workers in this field are young women who may be leaving their jobs for marriage and family responsibilities. Good employment opportunities will also continue for mature persons who are adequately trained or experienced and for persons interested in part-time work. Women returning to this field after several years' absence may find a refresher course necessary. Although some approved schools do not accept applicants over 30 years of age, others have no age restrictions on admissions.

Over the long run, the same factors responsible for the current shortage may be expected to continue. This expanding demand for laboratory technologists is based largely on: Anticipated population gains; increasing proportions of the very young and old-age groups which often necessitate special medical services; rising health standards; extending interest in preventive medicine; widening participation in health and hospitalization insurance programs; and the growing volume and complexity of laboratory procedures associated with new developments and discoveries in the field of medicine.

Earnings and Working Conditions

Weekly salaries of women medical technologists working full time in government and private hospitals averaged from $57.00 in Philadelphia ($62.50 for men) to $83.50 (same for men) in Los Angeles, according to a 1956–57 survey conducted by the Department of Labor's Bureau of Labor Statistics in 16 metropolitan areas. These salaries did not include premium pay or the value of meals, uniforms, and other supplements. It was also found that earnings of women technologists tended to be about the same as for general duty nurses. A nationwide survey conducted by the Registry of Medical Technologists and the National Committee for Careers in Medical Technology covering about 8,000 employed M.T. (ASCP's) revealed that the median yearly earnings in 1958 amounted to $4,469. Medical technologists who meet requirements set by the Federal Government start at $4,040 a year and may earn up to $7,030 or more. Salaries in both public and private institutions vary from laboratory to laboratory, of course, but they are likely to be determined, to a large degree, by the level of skill, extent of education and experience, and responsibility of the positions. Even though the technologist may specialize in a particular field, all-round skills and the ability to supervise or instruct often command higher pay.

Most full-time laboratory technologists work 8 hours a day and 40 to 44 hours a week. They generally are provided vacation and sick-leave benefits, and almost all are covered by private retirement plans or Federal social security. Where night or emergency work is required, there are usually provisions for extra pay or matching time off.

One of the important techniques learned in the training course is the extreme care required in the handling of specimens, materials, and equipment. Few hazards exist in laboratory work when proper methods of sterilization and of handling bacteria and tissue are observed. Technologists must, however, be willing to work in surroundings where unpleasant odors, diseased tissue, and blood are often present.

Where To Go for More Information

Additional details about medical technologists, as well as some related medical laboratory jobs are given in the following publication: Employment Opportunities for Women as Medical Technologists and Laboratory Technicians. Women's Bureau Bulletin 203-4, 1956. Superintendent of Documents, Washington 25, D.C. Price 25 cents.

Information, particularly on the M.T. (ASCP) and approved schools of medical technology, may be obtained from:

Registry of Medical Technologists of the American Society of Clinical Pathologists,
P.O. Box 44, Muncie, Ind.

American Society of Medical Technologists,
Suite 25, Hermann Professional Bldg., Houston, Tex.

Chiropractors

(D.O.T. 0-39.90)

Nature of Work

Chiropractic is a system of treatment based on the belief that the nerve system largely determines the state of health of the human body and that any interference with this system impairs normal functions and lowers the body's resistance to disease. Chiropractors treat their patients primarily by specific adjustment of parts of the body, especially the spinal column. Many also use such supplementary measures as diet, exercise, rest, water, light, and heat. Because of the emphasis on the spine and its position, most chiropractors use X-ray extensively in their practice to aid in locating the source of the patient's difficulty. Chiropractic as a system of healing does not include the use of drugs or surgery.

Where Employed

More than 25,000 chiropractors were employed in the United States in 1957, according to an estimate by The National Chiropractic Association. The greatest numbers were engaged in independent private practice. Some were employed by athletic organizations and industrial firms; others taught or did research work at chiropractic schools. A few worked on the staffs of chiropractic clinics or as salaried assistants to established practitioners. About 40 percent of all chiropractors were located in California, New York, Texas, and Ohio.

Training and Other Qualifications

Most States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. As of 1957, four States—Louisiana, Massachusetts, Mississippi, and New York—did not regulate the practice of chiropractic nor issue licenses to chiropractors.

The type of practice permitted and the educational requirements for licensure vary considerably from one State to another. Most States require 4 years of training in a chiropractic school following high school graduation. Over one-third also require 1 or 2 years of preparatory college work before chiropractic training. In a few States, considerably less than 4 years of chiropractic education is sufficient to qualify for a license. Qualified chiropractors licensed in one State may generally obtain a license to practice in another State without further examination.

Approximately two-thirds of the 16 chiropractic schools in the United States restrict their teaching to manipulation and spinal adjustments. The others offer a broader curriculum including training in such subjects as chiropractic physiotherapy and clinical nutrition. In the 7 chiropractic schools accredited by the Council on Education of the National Chiropractic Association, the first 2 years of the 4-year curriculum are devoted chiefly to classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. The last 2 years are spent in obtaining practical experience in the schools' clinics. The degree of doctor of chiropractic (D.C.) is awarded by all schools to students completing chiropractic training.

Most newly licensed chiropractors open their own offices or purchase an established practice. Some start as assistants to other chiropractors in order to acquire experience and funds. A considerable financial investment is usually necessary to open an office and equip it properly. Among the personal qualities considered desirable for a practitioner is the ability to deal with people sympathetically. The work does not call for unusual strength or endurance but does require considerable dexterity with the hands.

Employment Outlook

The success of the new practitioner will depend in large part on proper selection of a location for practice. Opportunities for beginning chiropractors will continue to be best in those parts of the country where chiropractic is most fully accepted as a method of treatment. Moreover, small towns or suburban areas, where the young practitioner can become known more quickly than in a big city, offer the best prospects for developing a practice.

The wide variation in community acceptance and in State laws is reflected in the concentration of chiropractors in certain areas. The highest proportion of chiropractors in relation to population is in the western States. In 1952, there were 30 or more chiropractors for each 100,000 persons in California, Oregon, Kansas, and Colorado compared with 15 chiropractors for each 100,000 persons in the country as a whole.

Employment opportunities are expected to be greatest for new entrants who are able to meet the highest State licensing requirements, including graduation from a 4-year course of 4,000 or more hours. In view of the trend in many States toward raising the educational requirements for practicing chiropractic, thorough training will become increasingly important.

Women are expected to continue to find good opportunities in this field as some women and children prefer to go to women chiropractors for treatment. About 15 percent of the chiropractors in practice are women, and all chiropractic schools accept women as students.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low at the beginning but rise after the first few years. Incomes of individual chiropractors vary greatly with ability, experience, the income level of the community, office location, and other factors. The National Chiropractic Association estimated that the average income above expenses was over $10,000 a year in 1957.

Where To Go for More Information

Information on State licensing requirements may be obtained by writing to the State board of licensing in the capital of the State in which the individual plans to practice. General information on chiropractic as a career may be obtained from:

National Chiropractic Association,
National Building, Webster City, Iowa

Optometrists

(D.O.T. 0–39.92)

Nature of Work

Optometrists examine eyes and do other work concerned with safeguarding and improving vision. They use special instruments and tests to find and measure defects in vision and, when needed, prescribe eyeglasses, eye exercises, or other treatment that does not require drugs or surgery. Most optometrists supply their patients with the eyeglasses prescribed. However, they usually have the lenses ground at an optical laboratory and then cut them to fit the frames selected by patients. Some optometrists do only minor repair work, such as straightening frames or replacing nose pieces on glasses.

Optometrist using special instrument in examining patient's eyes.

A growing number of optometrists include visual training, the use of corrective eye exercises, in their practice. Some do other specialized work such as fitting persons who are nearly blind with telescopic spectacles, fitting contact lenses, studying the relationship of vision to highway safety, and analyzing lighting and other conditions that affect the efficiency of workers in industry. A few optometrists are engaged primarily in teaching or research.

Optometrists should not be confused with ophthalmologists, oculists, or opticians. Ophthalmologists and oculists are licensed physicians who specialize in the medical and surgical care of the eyes and may prescribe drugs or other treatment, as well as lenses. Opticians (see index) grind lenses according to prescriptions for eyeglasses written by physicians who are medical eye specialists or by optometrists; they do not examine eyes or prescribe treatment.

Where Employed

Most of the 17,000 optometrists professionally active in early 1958 were in private practice in their own offices. However, some were salaried employees working as assistants to established practitioners or for health clinics, hospitals, optical instrument manufacturers, and government agencies. A few taught in colleges of optometry or served as optometrists in the Armed Forces.

Optometrists are located chiefly in large cities and industrial areas where many people are engaged in office work or other occupations which place a strain on the eyes. Nearly 40 percent are in the 4 States with the greatest population—Illinois, California, New York, and Pennsylvania. Many small towns and rural areas, especially in the South, have no optometrists.

Training and Other Qualifications

A license is required in all States and the District of Columbia for the practice of optometry. To obtain a license, one must be a graduate of an accredited school of optometry and pass a State Board examination. In some States, only graduates of certain accredited schools of optometry are admitted to these examinations. A student planning to become an optometrist should, therefore, choose a school approved by the Board of Optometry in the State where he expects to practice. Altogether, there were 10 schools of optometry in the country in 1958.

Five years of study beyond high school is the minimum education needed to become an optometrist. Usually this consists of 2 years of preoptometry education in an approved college, followed by 3 years of training in an optometry school. Some schools require a total of 6 years—2 of preoptometry study and 4 in a school of optometry. Preoptometry courses include mathematics and the basic sciences of physics, biology, and chemistry, as well as general education courses. The curriculum in schools of optometry provides not only for classroom and laboratory work but also experience in treating patients in the school's clinic. Most schools give their graduates the degree of Doctor of Optometry (O.D.) but some confer the degree of Bachelor of Science in Optometry or Master of Optometry. Optometrists who wish to specialize often take additional training. The master's or Ph. D. degree in physiological optics or a related field is usually required for teaching and research work.

Qualifications considered important for a prospective optometrist are a liking for mathematical and scientific work, the ability to use delicate precision instruments, mechanical aptitude, and good vision. In addition, successful practice requires the ability to deal with people tactfully. In 1958, applicants with the necessary qualifications had an excellent chance of admittance to a school of optometry.

The majority of optometrists start either by setting up a new practice or by purchasing an established one. Some begin as assistants to established practitioners, and young graduates are frequently advised to do this in order to acquire experience and the funds necessary to equip an office. Office location is of major importance for a successful practice. The optometrist should consider the number of optometrists and medical eye specialists in the vicinity compared with the number, occupation, age, and income level of the population requiring eye care.

Employment Outlook

Employment opportunities for new graduates of schools of optometry in the early 1960's are expected to arise mainly from the need to replace optometrists retiring or otherwise leaving the field. During this period, the number of new graduates is likely to be considerably less than the number of experienced optometrists dropping out of practice. As in the past, opportunities for beginning practice will generally be best in small towns and in residential areas of cities where the new optometrist can easily become known and where competition with established optometrists and medical eye specialists is not as keen as in large business centers. Communities, especially in the South, that have no optometric services available will also offer some opportunities for new graduates.

The demand for eye-care services will continue to grow over the long run. The importance of good vision to efficiency at work and in school is becoming more widely recognized; eye strain has been increased by many aspects of modern living; and the use of eyeglasses has come to be generally accepted. The volume of eye-care services needed will also be increased by the anticipated growth in population, especially by the expected sharp rise in the number of older people—the group most likely to need glasses. Although the expanded demand will be met in part by medical doctors who are eye specialists, optometrists will continue to supply a substantial proportion of all eye-care services.

Women optometrists, who constitute about 5 percent of the profession, have many opportunities to work as salaried assistants, especially in the field of visual training. Those in private practice have been particularly successful in work with children.

Earnings and Working Conditions

In optometry, as in some of the other health fields, a low income must be expected for the first 2 or 3 years of practice. However, as a practice becomes established, earnings usually rise significantly. In 1957, the average income above expenses for self-employed optometrists was $9,750, according to The American Optometric Association.

Optometrists practicing in towns and small cities have higher net earnings, on the average, than optometrists in large cities. However, there are some successful practitioners in big cities who have very high incomes. Although optometrists in salaried positions may at first earn more than the self-employed, earnings of those in practice for themselves usually outstrip incomes of salaried optometrists after a few years of experience.

Working hours in this profession are usually regular. Many offices are open 6 days and at least one night each week. However, some practitioners keep only scheduled appointments. Since the work is not strenuous, optometrists can often continue to practice after the normal retirement age.

Where To Go for More Information

Additional information on optometry as a career is available from:

American Optometric Association, Inc.,
4030 Chouteau Ave., St. Louis 10, Mo.

Information on required preoptometry courses may be obtained by writing to the optometry school in which the prospective student wishes to enroll. The Board of Optometry in the capital of the State in which the student plans to practice will provide a list of optometry schools approved by that State.

Veterinarians

(D.O.T. 0–34.10)

Nature of Work

Veterinarians (doctors of veterinary medicine) treat sick and injured animals. They also give advice regarding the care and breeding of animals and help to prevent the outbreak and spread of diseases among them by physical examinations, tests, and vaccinations. Since many animal diseases can be transmitted to people, this work is important to the public health.

Most veterinarians are general practitioners who take care of both large and small animals. Of those who are specialists, the greatest number are in "pet practice," often operating hospitals with boarding facilities for dogs and cats. A few veterinarians are poultry specialists, and some others work only with "prize" livestock and thoroughbred horses. Some veterinarians are engaged in inspecting meat, poultry, and other foods, as a part of the public health programs of the Federal Government and many State governments. A small number teach in colleges or do public health or other research related to animal diseases, drugs, and foods.

Since animals cannot describe how they feel, veterinarians must diagnose diseases and injuries on the basis of appearance and behavior and by taking temperatures and making tests. When needed, veterinarians operate on animals and prescribe and administer drugs, medicines, biologicals, serums, and vaccines. They use X-ray machines, hypodermic needles, syringes, and other medical equipment especially adapted for use with animals. They may treat animals on the farm—sometimes in open fields—or in veterinary clinics or hospitals.

Where Employed

Slightly more than 18,000 veterinarians—5 percent of whom were women—were professionally active in the United States in 1958. Of these, nearly two-thirds were in private practice. The

COURTESY OF U.S. DEPARTMENT OF AGRICULTURE

Veterinarians must often treat animals out of doors.

second largest number worked for the Federal Government—chiefly in the U.S. Department of Agriculture, which employed about 1,500 veterinarians full time and over 5,000 part time; a few worked for the U.S. Public Health Service and international health organizations. Nearly 800 were commissioned officers in the Veterinary Corps of the Army and the Air Force. In addition, a substantial number worked for State and local government agencies. Some were also employed by schools of veterinary medicine, State agricultural colleges, animal food companies, and pharmaceutical companies that manufacture drugs for animals.

Veterinarians practice in all parts of the country, although they are located chiefly in States where a large percentage of the Nation's livestock is raised. In 1958, one-third of the Nation's veterinarians were in 5 States—California, with about 1,500; and New York, Illinois, Iowa, and Ohio, with over 1,000 each. Veterinarians in rural areas deal chiefly with large animals, those in small towns usually engage in general practice, while those in cities frequently limit their practice to pet animals.

Training and Other Qualifications

A license is required in all States and the District of Columbia for the practice of veterinary medicine. To obtain a license, applicants must, as a rule, be graduates of approved veterinary schools and must pass a State Board examination. A few States also require some practical experience under the supervision of a licensed veterinarian. A limited number issue licenses without examination to veterinarians who have passed an examination in another State.

Two years of preveterinary college work followed by 4 years of professional study in a school of veterinary medicine are the minimum requirements for the degree of Doctor of Veterinary Medicine (D.V.M.). However, it may take 3 years to complete the preveterinary curriculum, which concentrates on chemistry and other science courses. The veterinary school training includes considerable practical experience in treatment of animals, as well as laboratory work in anatomy, biochemistry, and other scientific and medical fields. For positions in public health or other research or college teaching, the master's or Ph. D. degree in a field such as pathology, public health, or bacteriology may be required in addition to the D.V.M.

There were 18 colleges of veterinary medicine in the United States in 1959. Each year many more young people apply for admission than can be accepted. Some of the qualifications considered in selecting students are: Good scholastic records, amount and character of preveterinary training (in 1958, about one-fourth of the students selected had a bachelor's degree), a farm background, good health, and a liking for animals. Opportunities for women students are limited; most veterinary colleges are reluctant to admit them. Since veterinary colleges are largely State supported, residents of the State in which the school is located are almost always given preference. In the South and West, regional educational plans have been developed that permit cooperating States without veterinary schools to send a few students to designated regional schools. The regional school is paid a stipulated sum by the home State of each student. In other areas, schools may informally decide to accept a certain number of students from other States, often giving priority to applicants from nearby States without veterinary schools.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many establish their own practice and start with a modest financial investment in such essentials as drugs, instruments, and a car. Those operating animal hospitals or purchasing an established practice have to make a substantial investment. Newly qualified veterinarians entering the Army or Air Force are commissioned as first lieutenants. New graduates of accredited veterinary schools can quality for Federal civil-service positions, such as meat and poultry inspectors, disease-control workers, and research assistants. In addition, a program conducted by the U.S. Department of Agriculture offers junior students of veterinary medicine opportunities to serve as trainees during the summer months.

Employment Outlook

Graduates of schools of veterinary medicine will probably continue to have good employment opportunities throughout the 1960's. Since 1940, the supply of graduates has not been large enough to meet the total demand for veterinarians in private practice, government service, and colleges. However, 8 additional veterinary schools have been established since World War II. With the resulting increase in the supply of new veterinarians, the overall shortage in the profession will tend to lessen. Many of the opportunities to enter private practice or salaried employment will arise from the need to replace veterinarians lost to the profession through retirement or death. Because many veterinarians are in the older age groups, it is anticipated that replacement needs will continue to absorb nearly half the approximately 900 veterinarians who will graduate each year from existing schools.

A gradual expansion in employment of veterinarians can be expected in the long run. More veterinarians will be needed to care for the increased number of animals required to feed the country's expanding population. The trend toward suburban living is expected to bring about a large growth in the pet population and thus create a greater demand for pet animal specialists. Emphasis on scientific methods of raising and breeding livestock and poultry will continue to increase, and public health and disease control programs are expected to grow. More teachers will be needed to meet the anticipated rise in agricultural college enrollment, and veterinary research will expand further. In addition, developing programs in international public health and atomic energy research will offer a few opportunities.

The need for replacements and the anticipated growth in demand for veterinary services, when related to the limited number of veterinarians that can be trained each year by existing schools, point toward continued favorable opportunities for veterinarians in the long run. However, the demand for veterinary service is closely related to economic conditions. Since the market value of a farm animal largely determines how much its owner can afford to spend on its care, any major economic recession would greatly affect incomes and employment opportunities in large-animal practice.

Earnings and Working Conditions

New graduates in veterinary medicine had a starting salary of $5,430 a year in full-time positions with the Federal Government in 1958; after 6 months, they could usually qualify for positions paying $6,135 annually. Summer trainees in the U.S. Department of Agriculture were paid at the rate of $4,040 a year ($78 per week actually employed). Veterinarians commissioned as first lieutenants in the Army and Air Force received pay and allowances totaling approximately $6,000 per year. In 1956, veterinarians employed by local public health agencies had an average (median) salary of about $7,400.

Beginning veterinarians employed in animal hospitals received monthly salaries ranging from $350 to more than $600, according to a 1958 survey made by the American Animal Hospital Association. Nearly two-thirds of these inexperienced veterinarians earned between $350 and $450 monthly; about one-fourth were paid between $450 and $500; and the remainder (about 15 percent) received more than $500. About half the experienced veterinarians were paid from $500 to $650 per month. Salaried veterinarians engaged in pet practice may be furnished with lodgings in addition to their salaries; moreover, they sometimes share in the income of the animal hospital.

Veterinarians beginning their own practice can generally cover their expenses the first year and may often add to their earnings by working part-time for government agencies. The average income above expenses in 1955 was about $10,700 for veterinarians in private practice, according to a survey by the American Veterinary Medical Association. Income from private practice varies according to length of time in practice, location, and type of practice. Very successful practitioners sometimes earn $20,000 or more a year.

Veterinarians are sometimes exposed to danger of physical injury, disease, and infection. Working hours for those in private practice are likely to be irregular, and those in rural areas may have to spend much time traveling to and from distant farms. Veterinarians can continue working well beyond the normal retirement age because of the many opportunities for part-time employment or practice.

Where To Go for More Information

Additional information on veterinary medicine as a career, as well as a list of schools providing training, may be obtained from:

American Veterinary Medical Association,
600 South Michigan Ave., Chicago 5, Ill.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Agricultural Research Service,
U.S. Department of Agriculture, Washington 25, D.C.

Osteopathic Physicians

(D.O.T. 0–39.96)

Nature of Work

Osteopathic physicians are members of a school of medicine which emphasizes manual manipulation but also uses surgery, drugs, and all other accepted methods of medical care. Most are "family doctors" who engage in general practice. These physicians usually have office hours, make house calls, and also treat patients in osteopathic hospitals. A few doctors of osteopathy are engaged primarily in research, teaching, or writing and editing scientific books and journals. A small but growing number specialize in 1 of the following 12 fields recognized by approved specialty examining boards: Internal medicine, neurology and psychiatry, ophthalmology and otorhinolaryngology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology and syphilology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Where Employed

Nearly all of the 12,800 osteopathic physicians professionally active in the United States in 1958 were in private practice. Less than 5 percent held full-time salaried positions, mainly in osteopathic hospitals and colleges. A few were employed by private industry or Government agencies.

Osteopathic physicians are located chiefly in those States which place little or no limitation on practice and also have osteopathic hospital facilities. In 1958, slightly over half of all osteopathic physicians were in the following 5 States: California, with more than 2,000; Michigan, Pennsylvania, and Missouri each with more than 1,000; and Ohio, with almost 800. In each of 26 States, however, there were fewer than 100 osteopathic physicians.

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Training and Other Qualifications

A license to practice as an osteopathic physician is required in all States. However, the scope of practice allowed differs among the States. Many States and the District of Columbia issue licenses permitting osteopathic physicians to engage in all types of medical and surgical practice. Some States, however, limit osteopathic practice, principally regarding the use of drugs or the type of surgery that may be performed.

To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 21 States and the District of Columbia, passing an examination in the basic sciences is necessary before a candidate is eligible to take the professional examination. Some States also require a period of internship after graduation from osteopathic school. All States except Florida and Rhode Island will usually grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

Three years of preosteopathic college work followed by 4 years of professional study in an osteopathic college are the minimum requirements for the degree of doctor of osteopathy (D.O.). Preosteopathic education must include a specified number of credits in chemistry, physics, biology, and English. During the first 2 years of professional training, emphasis is on basic sciences such an anatomy, physiology, and pathology and on the principles of osteopathy; the last 2 years are largely devoted to work with patients in hospitals and clinics.

After graduation, almost all doctors of osteopathy serve a 12-month internship at 1 of the 94 osteopathic hospitals which the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have at least 3 years of additional training followed by 2 years of supervised practice in the specialty.

Every year, more young people apply for admission to the six approved schools of osteopathy than can be accepted. In selecting students, consideration is given to grades in preprofessional education, desire to serve as an osteopathic physician rather than as a doctor trained in other schools of medicine, scores on medical aptitude tests, and the amount of preosteopathic college work completed (in 1958, over 70 percent of the students accepted had bachelor's degrees). Considerable weight is also given to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathy usually establish their own practice. A few work as assistants to experienced physicians or become associated with osteopathic hospitals. In view of the variation in State laws regulating the practice of osteopathy, careful study should be given to the professional and legal requirements of the State in which the osteopathic physician plans to practice. Also, the availability of osteopathic hospital and clinical facilities should be taken into account when choosing a location.

Employment Outlook

Opportunities for osteopathic physicians will remain excellent throughout the early part of the 1960 decade in those parts of the country where osteopathy is a commonly accepted form of medical care. Greatest demand will probably be in California, Pennsylvania, and a number of midwestern States; growing opportunities are also anticipated in the Southwest and Northwest. Prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where the young doctor of osteopathy can become known more easily than in the centers of large cities.

Growth in the profession of osteopathy will continue to be slow in the early 1960's unless training facilities expand beyond the slight additions contemplated in late 1958. Although approximately 460 doctors of osteopathy are graduated each year, many of these are needed to replace those lost to the profession through retirement or death.

In the long run, opportunities for osteopathic physicians will probably continue to be good owing to the likelihood of increased public acceptance of osteopathy, liberalization of certain State licensing laws, and the establishment of additional osteopathic hospitals. In addition, the demand for all kinds of medical care—including the services of osteopathic physicians—will continue to grow as a result of the increase in population, Government provisions of medical services for veterans and members of the Armed Forces, the development of prepayment plans for medical care and hospitalization, and the underlying trend toward higher standards of health care.

Women osteopathic physicians will find good opportunities not only in private practice but also on faculties of osteopathic colleges and on the staffs of hospitals and clinics. Approximately 7 percent of all osteopathic physicians are women. Although men and women are equally eligible for admission to osteopathic colleges, the proportion of applications from women has been declining. In 1958, women students represented about 2 percent of the total enrollment.

Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first years of practice. Earnings of individual doctors of osteopathy vary greatly with ability, experience, the income level of the community served, geographic location, and other factors. Surgeons and other specialists usually earn more than those in general practice.

Many osteopathic physicians work more than 50 and 60 hours a week. Those in general practice work longer and more irregular hours than surgeons and specialists.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. A list of State boards, as well as general information on osteopathy as a career, may be obtained from:

American Osteopathic Association,
212 E. Ohio St., Chicago 11, Ill.

Dental Hygienists*

(D.O.T. 0–50.07)

Nature of Work

The dental hygienist seeks to promote oral health by preventive treatment and instruction in proper care of the mouth. Working under the direction of licensed dentists, dental hygienists perform "oral prophylaxis," which includes scaling of calcium deposits, removal of stains, polishing of teeth, and massage of gums. In the course of this cleaning of teeth, they inspect and chart the mouth to detect defects for final examination and diagnosis by a dentist, and at the same time give advice to the patient on proper diet and personal care of the teeth. They also may take and develop X-ray pictures of the patients' teeth to facilitate diagnosis by the dentist. In many localities, they also apply sodium fluoride solution to children's teeth to reduce decay.

Dental hygienists who work for private dentists may also prepare filling compounds, sterilize instruments, and perform other clinical work, in addition to assisting the dentist with patients and in the laboratory. In some dental offices, dental hygienists handle some of the duties generally assigned to dental assistants such as making appointments, receiving patients, answering telephones, ordering supplies, sending out monthly statements, and other recordkeeping activities.

Dental hygienists who are employed by school systems usually go from school to school to examine the children's teeth periodically, after which they notify parents of any discovered defects which require dentists' services. They may also give classroom instruction, sometimes with visual aids, on correct toothbrushing technique and proper diet, in addition to acquainting teachers with dental health facts and assisting them in the preparation of classroom projects or assembly programs on oral health. Dental hygienists may also conduct group discussions at Parent-Teacher Associations and other adult organizations and at meetings with administrative and teaching staffs of schools. In some school systems, they make home visits to explain to parents the importance of good dental care; in others, they perform clinical duties for groups of children and assist in the maintenance of dental clinics for those who cannot afford private dental care.

Dental hygienists employed in hospitals, institutions, or public health clinics may also be called upon to work with the physically handicapped and bed patients. A few also assist in research projects and some give lectures to dental students and hospital aids on various aspects of preventive dental health education. Others in the field of public health serve as consultants, set up local dental health projects, provide educational materials, and work with community groups. Some work in rural area dental trailers, traveling from one farm to another where dental facilities are unavailable.

Dental hygienist giving instruction in proper toothbrushing method.

Where Employed

An estimated 6,000 dental hygienists were employed in 1958, most of them in the eastern part of the United States. Although health facilities are maintained by most communities in the United States, approximately 40 percent of all practicing hygienists were located in only three States (New York, Pennsylvania, and Connecticut). Virtually all were women, largely due to the

*Prepared by the Women's Bureau, U.S. Department of Labor.

practice by dental hygiene schools of limiting admission to women only.

Most dental hygienists work in private dental offices. A growing number, however, are being employed by public school systems and public health agencies, as well as in hospital clinics and other health institutions, both public and private and on staffs of dental and dental hygiene schools. A few dental hygienists work in industrial plants and union-sponsored clinics and in Armed Forces installations.

Training and Other Qualifications

Dental hygienists must be licensed by a State board of dental examiners in the State in which they wish to practice. All but two States (Alabama and Georgia) require graduation from a dental hygiene school for eligibility for the licensure examination. In the various States, licensure fees, including cost of examination, range from $10 to $75, with most fees set at no higher than $25. Upon passing a licensing examination, the hygienist becomes a Registered Dental Hygienist (R.D.H.) in the State in which the examination was taken. Because each State has its own statutory requirements, and only a few States offer reciprocity, a licensed dental hygienist usually must take another examination in order to relocate in a different State. Periodic registration (at fees varying from $1 to $15) is also required in most States.

Training for work as a dental hygienist may be secured in 34 schools of dental hygiene located in 24 States. The Council on Dental Education of the American Dental Association had, by May 1958, fully accredited 31 of these schools; the 3 others were provisionally approved. Of all these schools, 26 are associated with the dental programs of universities and the remaining 8 are parts of institutes, colleges, or universities that do not have dental schools. Eighteen dental hygiene schools offer only a basic 2-year dental hygiene certificate course; in 13 schools, training consists of either a 2-year course for a diploma or a 4-year program leading to a degree; 3 schools offer only a 4-year curriculum leading to the bachelor's degree with a major in dental hygiene.

To be admitted to an approved school of dental hygiene, the student must at least have finished a college preparatory course or its equivalent in a secondary school. However, more and more schools are giving admission preference to students with some college training. (Nearly one-third of the 1,160 freshmen accepted in 1957–58 had 1 or more years of college training.) Most schools require aptitude tests for applicants. Competence in mathematics and sciences such as biology and chemistry may also be required. Admission to dental hygiene schools is limited to women. The minimum age requirement for entrance varies among approved schools—from 17 to 21 years of age. Maximum age limits also vary, but most schools do not accept students over 35 years of age.

The 2 years' training in dental hygiene includes instruction in the required manual skills and in methods of teaching, as well as courses in anatomy and other biological sciences, chemistry, pharmacology, nutrition, and X-ray. Special emphasis is placed upon the dental aspects of these subjects, and the student spends a substantial amount of time in laboratory work gaining clinical experience. Sufficient additional courses to meet the requirements for the bachelor's degree are provided in the 4-year course. In 1958, the 3 schools offering only the 4-year degree program required that the first 2 years be spent in college liberal arts courses and the last 2 years in dental hygiene studies. For those who plan to work in the fields of public health and education, the 4-year program is desirable. At some schools, short-term "refresher" courses are available to graduates.

According to a recent survey, school costs including tuition, and other fees, books, supplies, and equipment but not including living expenses averaged about $1,100 for the 2-year dental hygiene course. Approximately two-thirds of this amount was for tuition and fees. The cost of the 4-year degree program would, of course, be proportionately more. A number of scholarships and loans are available from schools, government, and alumnae and other private organizations to defray the cost of dental hygiene education. One such arrangement is the traineeship program provided by the U.S. Department of Health, Education, and Welfare which includes payment of tuition and a stipend for living expenses for graduate or specialized public health training.

Among the desirable personal characteristics that a dental hygienist should possess, tact and a pleasant manner as well as manual dexterity are particularly important. Other helpful qualities include emotional maturity, patience, orderliness, a liking for detail, and the ability to master basic scientific subjects.

For special types of work, such as supervisors of dental health programs in public schools and in health departments and teachers and directors of training schools for dental hygienists, a bachelor's or advanced degree in health education or administration is becoming required more and more. Advanced education will also be emphasized for the filling of new positions that may be created in public health, such as counseling, consulting, administration, or program planning. Other fields for which special training will probably be required include research where a knowledge of sciences and statistical methods is helpful, or work with the handicapped and other special groups.

Employment Outlook

Although the number of graduates (945) in 1957 was almost double the number in 1950, reports indicate that about twice as many could have been employed and that employment opportunities for dental hygienists were excellent in 1958. This demand is expected to continue and expand well into the 1960's. Many openings are created each year by relatively high turnover among young women in the field who leave their jobs for marriage and family responsibilities.

A number of specialized types of work are expanding for experienced dental hygienists. Those with additional education beyond the 2-year hygienist course (and some practical training) may seek teaching, supervisory, or administrative positions in training schools for dental hygienists. Hygienists with foreign language ability, emotional maturity, experience in public health and schools, and an interest in working as consultants overseas or in establishing foreign training programs for dental hygienists may look toward opportunities abroad.

Various studies indicate that only a small proportion of dentists employ hygienists but that effective use of such personnel leads to improved dental service. As more dental students become introduced to the idea of working with hygienists and as increasing numbers of established dentists come to recognize their value, a still greater demand for hygienists may be expected.

Because of the relatively high earnings of dental hygienists in private dental offices, the somewhat limited possibilities for advancement may not be considered as too great a drawback in choosing this career. While opportunities for supervisory work in private offices are restricted because few have more than one hygienist, some hygienists serve as office managers or supervise auxiliary aids such as dental assistants, secretaries, or receptionists.

Additional openings for dental hygienists will be created by the increasing emphasis on preventive health measures, including early and regular dental care and expanding dental programs in schools and in public health services. A further need for the services of hygienists will result from a growing population and higher income and educational levels. Other factors contributing to the favorable employment prospects for dental hygienists include increased use of new techniques such as fluoride applications and greater participation in prepayment group plans and in industrial and union dental programs.

Since part-time practice is feasible in this occupation, many hygienists who would otherwise be obliged to withdraw from the labor market because of family responsibilities can participate on a limited basis. Thus, over one-fifth of a nationwide group of surveyed hygienists reported that they worked only "part time" or "occasionally." Most part-time workers were found in the West.

As a result of the expanding demand, mature persons who wish to return to the profession or who can secure adequate training can expect to find good opportunities for employment.

Earnings and Working Conditions

Earnings for dental hygienists vary depending upon the location of the job, the type of employer, and the education and experience of the hygienist. Scattered reports in 1958 indicated that hygienists working for private practitioners earned up to $100 or more a week, either as straight salary or commissions while the beginning annual salary in the Federal service in 1958 was $3,755. Although salary only is the most frequent form of remuneration, commissions only or a combination of salary plus commission are the most prevalent forms of compensation in the South and West. An example of one type of commission arrangement is a guaranteed salary base plus 50 percent of the cleaning and X-ray fees. Salaries may be expected to advance in certain types of positions, as more hygienists continue toward higher levels of education, assume greater responsibilities, and fill supervisory positions created by the growth of the profession.

A 40-hour workweek is fairly usual for full-time hygienists, and working conditions are generally pleasant. However, some hygienists divide their time, working for two or more dentists a week. Hygienists generally provide their own uniforms which consist of a white nurse-type dress, shoes, and cap. Regular health check-ups as well as proper X-ray and sterilization techniques minimize risks of radiation exposure or of contracting infectious diseases from the patient's mouth. Stools are used as an aid in alleviating long periods of standing. A paid vacation of 2 or 3 weeks is common in most dental offices. Those working on a day-to-day basis have no leave provisions. Dental hygienists employed by public and private agencies, corporations, and school systems have the usual vacation, sick leave, and retirement benefits of such organizations.

Where To Go for More Information

Information about approved schools, training requirements, and job opportunities may be obtained from the following organization:

American Dental Hygienists' Association,
100 East Ohio St., Chicago 11, Ill.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in the State in which the dental hygienist wishes to practice.

Dietitians*

(D.O.T. 0–39.93)

Nature of Work and Where Employed

Dietitians are generally responsible for planning and supervising the preparation and serving of attractive and nutritious meals to help people maintain or recover good health. Their work usually includes the formulation of menus or modified diets, supervision of the food personnel who prepare and serve meals, management of purchases and accounts, and promotion of good eating habits.

Probably about 25,000 persons were employed as dietitians at the beginning of 1959, of whom approximately 5 percent worked part time. Although substantial numbers are employed in industrial plants and commercial eating places, about half of all dietitians are estimated to be engaged in hospital work. A 1957 survey made by the American Hospital Association indicated that there were almost 13,000 dietitians in 6,569 hospitals throughout the country. About 6,100 of these hospital dietitians were certified by The American Dietetic Association (for further information on certification, see below). All of the four major types of specialists to be found among professional dietitians are employed by hospitals.

Administrative dietitians, the largest group, are responsible for administering and directing food-service programs in either public or private organizations. In addition to hospitals, where the majority of them work, their places of employment include colleges and universities, industrial plants, commercial restaurants and cafeterias, airlines, school lunch programs, camps, and homes for the aged. Applying the principles of nutrition to large-scale planning and cooking, they supervise the preparation of meals which are both well-balanced and appealing.

In performing their job, staff dietitians select, train, and direct food personnel; manage the purchase of food, equipment, and supplies; enforce sanitary regulations; and prepare records and reports. In addition to administering these activities, the director and assistant director of a dietary department formulate departmental policy, coordinate dietary service with the activities of other departments, and are responsible for the management of the dietary department budget.

* Prepared by the Women's Bureau, U.S. Department of Labor.

Dietitian instructing a class of student nurses in the fundamentals of good eating.

Dietary consultants, employed by State health departments or other public agencies, visit a number of public hospitals, institutions, and sanatoriums to give technical advice on the maintenance of adequate diets for patients, methods of food preparation, food-service operation and management, selection and purchase of food and equipment, and kitchen layouts.

Therapeutic dietitians, usually employed in hospitals and clinics, plan meals as prescribed by physicians for individual patients who require modified diets because of such illnesses as diabetes, cardiovascular disease, or tuberculosis. In addition to translating special food requirements into attractive menus, they also supervise the preparation and serving of these meals. Duties of therapeutic dietitians include educating patients in the requirements and importance of their diets and suggesting ways for them to maintain their diets after leaving the hospital. Therapeutic dietitians who work primarily with outpatients in hospital clinics are usually called clinic dietitians. In the clinics, they discuss dietary needs and problems with individual patients or with groups of patients, such as expectant mothers or overweight persons.

Teaching dietitians are employed by hospitals, colleges, and universities to instruct classes in such subjects as dietetics, foods and nutrition, diet therapy, menu planning, budgeting, and institution management. The students may be dietetic interns, student nurses, medical or dental students, dietary employees, or others. In addition to classroom work, teaching dietitians supervise dietetic interns in the performance of their practical training. They also conduct less formalized and continuous inservice training for food service workers, and may be responsible for dietary instruction to individuals or groups of patients.

Research dietitians conduct experiments or surveys in food and nutrition to learn how foods can aid in the recovery of patients with different illnesses and in helping persons attain and maintain good health. They generally work as members of medical teams, along with physicians, nurses, physiologists, and others. Sponsored largely by government agencies, universities, large hospitals, and commercial organizations, much dietary research is currently directed at the nutritional needs of the aging and of persons with chronic diseases.

Training, Other Qualifications, and Advancement

Educational preparation recommended for a professional dietitian is 4 years of appropriate college work leading to a bachelor's degree, plus 1 year as a dietetic intern. Undergraduate study should include courses in foods and nutrition, institution management, chemistry, bacteriology, and physiology, as well as such related courses as psychology, sociology, and economics.

College graduates who meet specific academic requirements may enroll in 1 of the 65 dietetic internship programs approved by The American Dietetic Association. During the school year 1958–59, about 600 dietetic interns were enrolled in approved courses. As there was room for about 200 more interns, the existing internship programs were filled on the average to only three-fourths of capacity. Scholarships and loans are available to dietetic interns in numerous programs.

There are three types of internships: Hospital, food administration, and food clinic. The interns spend some time in the classroom and on special projects, but most of their training is gained by practical on-the-job experience under the supervision of a qualified dietitian. They may be provided room, board, and some laundry service without cost and usually receive a monetary stipend. In the Veterans Administration, the largest single employer of dietitians, dietetic interns are paid for the time they work at the rate of $4,040 a year for a 40-hour week. Living quarters and meals are provided at the hospitals for a nominal charge.

Many employers give hiring preference to dietitians who have completed an approved internship because they consider it evidence of adequate training. However, 3 years of experience as a dietitian is also considered to be acceptable if at least 1 year of work has been supervised by a member of The American Dietetic Association. Either of these two methods of preparation makes a dietitian eligible for certification by the Association.

Some junior colleges and vocational schools offer 2 to 3 years of training in dietetics, but this preparation is not considered adequate for professional work. Graduates of these programs may secure employment as food service supervisors, possibly in charge of food service in a small institution.

In addition to acceptable training, other essential requirements for work in the field of dietetics are a strong interest in and an aptitude for the sciences, particularly chemistry and mathematics. Good physical stamina is also needed, as well as ability to organize work programs effectively and to work with others satisfactorily. Young people who wish to test their interest in and adaptability to this profession will find it helpful to secure summer work experience in a hospital department of dietetics.

Experienced dietitians have good opportunities for advancement either in their own field or in related work. After a few years of experience, a dietitian may be eligible for promotion to director of dietetics or assistant director. Those engaged in teaching or research work usually find it necessary to do graduate study in order to advance to higher level jobs as supervisors or specialists in their field. Persons interested in becoming public health nutritionists usually earn a graduate degree in public health nutrition in 1 of the 12 colleges and universities offering this type of training. For positions as research nutritionists or nutrition consultants, graduate study in nutrition and related subjects is necessary.

Employment Outlook

Opportunities for professional dietitians are excellent. There is a continuing shortage of qualified dietitians, particularly in hospitals. New and expanded hospital facilities and more widespread use of hospital and medical services by our growing population have resulted in the need for many more hospital dietitians. In addition, there is growing understanding of the importance of nutrition in promoting good health from infancy through the mature years of life. Probably resulting from this awareness is the new interest on the part of employers in hiring dietitians for industrial feeding programs and commercial establishments. Expansion of school hot-lunch programs has also affected demand.

Added to the number of dietitians needed to fill new positions is the fairly heavy job turnover in this profession. Many young women choose this field of study because of their interest in food and homemaking and stop work because of marriage and family responsibilities. It has been estimated that new positions and replacements require the yearly addition of about 2,000 new dietitians. However, only about a third of this number are being graduated from dietetic internships each year.

Because of the present shortage, some hospitals and other establishments are hiring college graduates with suitable undergraduate training to assist a member of The American Dietetic Association and thereby gain the experience needed to become qualified dietitians. Small hospitals and institutions which do not require the services of a full-time dietitian are hiring dietitians on a part-time basis. Some of these dietitians are married women who have been encouraged to return to work. In addition, a number of dietitians, particularly those living in rural areas, find it advantageous to work part time for each of several institutions in their area.

Despite many measures being taken to help meet current demand, the shortage of professional dietitians is expected to continue throughout the next decade.

Earnings and Working Conditions

Salaries offered in 1958 ranged from about $3,900 to $5,400 for inexperienced graduates of approved dietetic internships and from $4,080 to $7,728 for qualified dietitians with experience, according to The American Dietetic Association. Positions for chief dietitians listed with the Association specified annual salaries ranging from $4,500 to $7,500 and for dietitians in charge of very large departments, from $8,000 to $12,000.

Starting salaries averaging $3,576 a year were paid in the winter of 1957–58 to the full-time dietetic workers among the recent women graduates covered by a joint survey of the National Vocational Guidance Association and the U.S. Department of Labor's Women's Bureau. As these women had graduated from college in June 1957, they had not obtained any experience or further training prior to employment.

In Veterans Administration hospitals, where the majority of Federal dietitians work, and in the U.S. Department of Health, Education, and Welfare, which employs most of the others, the starting salary for internship graduates without experience was $4,980 in 1958. Federal salaries increase with amount of experience and level of responsibility, ranging up to $13,970 for administrators and specialists.

Dietitians' positions listed by industrial companies with The American Dietetic Association indicated salaries averaging about $4,500 in 1958. College food services offered salaries ranging from $3,800 to $6,000 for assistant directors and from $6,000 to $10,000 for directors. The range for school lunchroom supervisors was from $5,000 to $9,000 and for teachers in colleges and universities, from $4,500 to $10,000.

Most dietitians have a regular 40-hour workweek. However, hospital dietitians are sometimes required to work weekends and the dietitians in restaurants and cafeterias often have somewhat irregular hours. Room, laundry service, and meals are occasionally provided in addition to cash salaries. Paid vacations and holidays are the general practice, along with sickness and retirement benefits.

Where To Go for More Information

Further information on approved dietetic internship programs, available scholarships, and employment opportunities may be obtained from:

The American Dietetic Association,
620 North Michigan Ave., Chicago 11, Ill.

The U.S. Civil Service Commission, Washington 25, D.C. has information on the requirements for dietetic interns and dietitians in Federal Government hospitals.

Physical Therapists*

(D.O.T. 0–39.935)

Nature of Work

Physical therapists (sometimes called physiotherapists) help persons with muscle, nerve, joint, or bone diseases or injuries try to regain use of the disabled parts of their bodies. Under a physician's direction, they use physical exercises, mechanical apparatus, and applications of massage, heat, light, water, or electricity to treat a variety of disorders. These include physical injuries, deformities, and disabilities resulting from poliomyelitis, cerebral palsy, and arthritis. Most of the patients are those who have been injured in work, home, or highway accidents; crippled children; and disabled veterans.

In the course of administering treatments, physical therapists keep records of each patient's progress. They also perform muscle and nerve tests to obtain information needed in carrying out a treatment program. Another of their duties is to help disabled persons accept their physical handicaps and learn how to live within their limitations. They may teach patients how to use and care for braces, crutches, and artificial limbs. In addition, they usually show patients and their families how to continue treatments at home.

Some physical therapists are responsible for the instruction of physical therapy students, students of related professions, or nonprofessional personnel (such as ward aids and orderlies). Since the therapists' work must be integrated

*Prepared by the Women's Bureau, U.S. Department of Labor.

Physical therapist helping a polio patient regain his sense of balance with use of a walker.

with that of the other members of the rehabilitation team responsible for a patient's total care, they also attend conferences at which the progress of patients is considered. A rehabilitation team is directed by a physician and may include a teacher, nurse, medical and psychiatric social worker, occupational therapist, psychologist, speech therapist, recreational worker, and vocational counselor.

Although qualified therapists may handle all types of patients, some specialize in working with children, veterans, amputees, or victims of poliomyelitis, cerebral palsy, or arthritis.

Where Employed

An estimated 8,000 qualified physical therapists were employed in 1958, of whom about 80 percent were women. They were working principally in metropolitan areas throughout the country. In proportion to population, there were considerably more physical therapists in the northeastern and western States than in the southern or central States.

The majority of qualified physical therapists are employed by hospitals. About half of these work in private, nonprofit hospitals; one-fourth in hospitals operated by State or local governments; and most of the remainder in Federal hospitals, which are operated principally by the Veterans Administration, Armed Forces, or U.S. Public Health Service. Most hospitals with physical therapists are large, general hospitals but some specialize in services for children or for the chronically ill. In recent years, more rural hospitals are including physical therapists on their staff.

More than one-fourth of all physical therapists are employed by rehabilitation or treatment centers, schools or societies for handicapped children, and public health agencies. Most of these organizations provide regular treatment for patients who are ill over a long period of time.

The remaining group of physical therapists work mainly in doctors' offices or clinics, teach physical therapy, or perform research on treatment procedures or in such basic sciences as anatomy or physiology. A few serve as directors or coordinators of departmental programs in large hospitals and rehabilitation centers or as consultants in governmental and private agencies.

Training and Other Qualifications

In 1958, there were 38 schools of physical therapy (including the Army Medical Service School) which had been approved by the American Medical Association. The majority of approved schools were part of large universities. Most of the others were operated by hospitals, which usually had university affiliations. All but six of the approved schools offered programs leading to a college degree. The degree program, which lasts 4 years, is open to high school graduates and, in some instances, to undergraduate students who have completed 2 years of general college work, including a certain number of required science courses. All but nine of the approved schools offered 12- to 16-month courses leading to a certificate in physical therapy. Entrance requirements for admission to certificate courses vary somewhat among schools but generally include possession of a baccalaureate degree and prior study of specific biological, physical, and social sciences.

Annual tuition in physical therapy schools ranges from a minimum of $75 in a State university (for State residents) to a maximum of

$1,100 in a private university. Numerous scholarships are being offered to students in an effort to attract more persons into the field. The principal source of scholarship funds is The National Foundation for Infantile Paralysis, which requires its recipients to work in the United States under the supervision of a qualified and experienced physical therapist for 1 year following completion of training.

Graduation from an AMA-approved school of physical therapy is required for a State license, for membership in the American Physical Therapy Association, and for registration with the American Registry of Physical Therapists. Most employers, particularly large hospitals and organizations, hire only therapists who have been graduated from an AMA-approved program. In 30 States and Hawaii, physical therapists must satisfy certain educational and employment standards set by a State board of examiners in order to obtain a license to practice.

With the increase of schools in this field, numerous teaching positions have become available for physical therapists. These positions are open to qualified physical therapists who have a college degree and who have had general clinical experience, preferably for at least 3 years. Opportunities for physical therapists to advance to supervisory and administrative positions exist mainly in large hospitals and organizations.

Important characteristics needed by physical therapists are emotional stability, a moderate amount of manual dexterity, and a strong interest in humanitarian service. Since physical therapists must help patients and their families understand the treatments given and must prepare them emotionally for changes that occur, those persons wishing to become therapists must have patience, resourcefulness, and a sympathetic attitude toward people. Good verbal expression in giving instructions; ability to plan and organize time, material, and work output; as well as good physical stamina are also needed by physical therapists.

Employment Outlook

The shortage of physical therapists, which began during World War II, continued to be acute in 1958, when about 5,000 job vacancies were reported. This need existed despite the fact that the number of physical therapy graduates from approved schools had more than tripled, rising from 238 in 1941 to 750 in 1957. Increased staff requirements have stemmed not only from population growth but also from greater public interest in the rehabilitation of all physically handicapped persons, including World War II veterans and the expanding group of older persons in the population.

The demand for physical therapists is expected to continue well into the 1960's, as a result of the increasing use of physical therapy in caring for the injured, diseased, and aged. Vocational rehabilitation and crippled children programs, in which States are aided by Federal funds, will further bolster the demand. More physicians are also expected to recommend physical therapy for their patients, as techniques and equipment for treating many diseases improve. In addition to new positions, many hundreds of job openings will result from turnover in the field, since the vast majority of workers are young women who may be leaving their jobs for marriage or family responsibilities.

It has been estimated that through the middle 1960's a minimum of 3,000 additional physical therapists will be needed each year for new positions and replacements. Since the supply of graduates from approved schools is expected to be insufficient to meet these needs, the employment outlook in this field appears to be excellent. Opportunities will be good not only for staff jobs but also for teaching positions in physical therapy schools and for positions in research programs. In recent years, an increasing number of men have entered the field. Over the long run, a steady rise in the employment of physical therapists is expected as advances in medical knowledge increase the life span of all the population, including the physically handicapped.

Earnings

Starting salaries of new graduates in physical therapy averaged $3,750 in 1958, according to the American Physical Therapy Association. Some salaries were supplemented by maintenance and/or meals and by the laundering of uniforms. Entrance salaries for physical therapists in the

Federal civil service (effective January 1958) ranged from $4,040 to $5,985 a year, depending on the previous experience of the applicant. At the same time, a starting rate of $4,063 including rental and subsistence payments was paid to therapists with a second lieutenant or ensign rating in the military services and also to junior assistants in the commissioned corps of the U.S. Public Health Service.

Salaries of supervisors were reported by the APTA in 1958 to range from $5,000 to $6,000 a year. For those employed as physical therapy directors or coordinators, salaries started at about $7,000 a year and increased with greater experience, competence, and responsibility.

Where To Go for More Information

Additional information concerning women as physical therapists is available in a U.S. Department of Labor, Women's Bureau publication, The Outlook for Women as Physical Therapists. Bulletin No. 203-1, Revised, 51 pp. Washington, D.C. 1952. Price 20 cents.

Information may also be obtained from:

American Physical Therapy Association,
1790 Broadway, New York 19, N.Y.

Medical Record Librarians*

(D.O.T. 0-23.25)

Nature of Work

Medical record librarians are responsible for the coordination of medical data based on detailed records of patients' illnesses and treatments.

They collect and catalog medical and surgical information on each patient, including reports on X-rays, operations, laboratory findings, doctors' orders, and progress notations; check records for completeness and accuracy; code diseases according to established standards; index diseases, operations, and other special study material; prepare daily census information and other regular statistical reports; abstract and transcribe case histories to permanent records; answer inquiries and prepare reports on individual cases; prepare reports for the use of physicians in their research work; analyze medical record contents to determine present and potential uses of data; and develop or improve procedures, forms, and methods used in keeping records and record systems. Since large hospitals are often centers of teaching and research for medical personnel, medical record librarians in such institutions participate in hospital education and research programs.

Records maintained by medical record librarians are used by physicians in studying medical histories, diagnosing illness, and prescribing care. They are also used for insurance claims, in legal actions, and in training medical and nursing and other related personnel. Medical record information is important to administrators in analyzing the health services offered by their organizations and in determining agency policies and procedures. The information is important also for research purposes, such as developing and evaluating new treatments and medications; and for community health planning.

In some hospitals, clinics, and other health organizations, several medical record librarians, as well as record technicians and clerical workers, may be employed, but often one qualified medical record librarian, with the help of clerical assistants, has responsibility for and supervision of all activities of the medical record department.

Chief medical record librarians, in addition to having supervisory and staff training duties, represent their departments in hospital staff meetings and may have to vouch for the accuracy of records if they are subpoenaed by the court. As voting members of hospital committees, they may influence major decisions affecting the efficiency of the hospital.

In addition to the medical record librarians concerned directly with the maintenance of records in medical care institutions, a few have unique administrative and research positions, and a few are employed as consultants.

The occupation of a medical record librarian should not be confused with that of a medical librarian whose work is chiefly with books and other publications, although in some hospitals the medical record librarian performs both functions.

Almost all medical record librarians are women.

*Prepared by the Women's Bureau, U.S. Department of Labor.

Ninety-nine percent of the members of the American Association of Medical Record Librarians in 1957 were women.

Where Employed

Most medical record librarians are employed in hospitals. Some work in clinics, medical research centers, medical departments of insurance companies and industrial establishments, health agencies, local and State health departments, regional hospital councils, and student health centers.

Since most hospitals are located in or near metropolitan areas, most medical record librarians work in the major population centers of the country.

In 1957, the American Hospital Association reported about 2,600 registered medical record librarians employed in the 6,500 private and government hospitals listed by the Association. A large majority of these were employed in general hospitals and some were employed in special hospitals such as those for psychiatric and tubercular patients. Approximately 20,000 additional persons were reported as other medical record personnel, including clerks, technicians, and nonregistered record librarians.

Training and Other Qualifications

Formal training is virtually essential for those planning to enter this occupation. Although many medical record librarians already employed received training in hospitals on an apprenticeship basis, today, the minimum requirement for registration is 2 years of college, or 3 years of professional nursing education, in addition to either a year of specialized medical record library training or 5 years of pertinent work experience. The specialized training is available at 30 hospital-based schools approved by the Council on Medical Education and Hospitals of the American Medical Association. To meet the need for semiprofessional workers, 12 additional hospital schools have been developed and approved by the Council for training medical record technicians.

The 30 schools approved for training of medical record librarians are located in 18 States and Puerto Rico and are under the supervision of a hospital or medical center. Two-thirds of the schools are college-affiliated. Enrollment capacity ranges from 4 to 20 students. Half of the schools admit both men and women as students; half admit only women.

Curriculums offered at these schools lead to bachelors' degrees or certificates of medical record library science. Generally, schools granting degrees require only high school graduation for admission to a full 4-year college program. Certificate-granting schools offer 12-month concentrated curriculums and usually require that applicants have 2 or more years of previous college training or that they be graduates of a recognized school of nursing.

To be approved by the Council on Medical Education and Hospitals, both the certificate and degree hospital schools are required to provide in their programs at least 50 weeks of theoretical instruction and practical experience in medical record library science. Required courses in theory include anatomy and physiology; fundamentals of medical science; medical terminology; management, including hospital organization, interdepartmental relations, purchasing, and supervision; psychology; and medical record library science, including historical development, legal aspects, ethics, securing and preserving of data, statistics, and indexing. Practical training involves hospital admitting and discharging procedures; standard indexing and coding practices; and acquaintance with the work of such adjunct departments as X-ray, pathology, medical library, outpatient, and social services.

In 27 of the 30 schools, yearly tuition is $350 or less. Tuition fees in the degree-granting schools are on the average slightly higher than those offering certificate programs.

Following completion of a degree or certificate program, graduates are eligible to take the registration examination of the American Association of Medical Record Librarians. Registration is considered to be a measure of professional attainment in this field, and many hospitals prefer to have at least one registered medical record librarian on their staff. Specific requirements for registration are: (1) membership in the association; (2) either graduation from an approved school or the combination of sufficient education to qualify for admission to an approved school plus pertinent work experience during 5 of the

6 immediately preceding years; and (3) passing a written examination.

Training at the technician level was introduced several years ago to meet critical demands for personnel who can assume some of the work requiring less responsibility. For high school graduates unable to spend 3 or 4 additional years in school, technician training offers an opportunity to enter the field in less demanding positions. The duration of technician courses offered at 12 hospital schools in 10 States is from 9 to 12 months. Four schools begin classes in summer; the rest in the fall. Student capacity ranges from two to eight. In 9 of the 12 schools, tuition is $100 or less. Eight of the schools enroll only women. Graduates are eligible to take an accreditation examination given by the American Association of Medical Record Librarians, and, on passing, may do technical work under the direct supervision of medical record librarians or hospital medical record committees.

Certain personal characteristics are required for successful and satisfying work in this occupation. Important among these are an interest in detail, accuracy, and a willingness to be persistent in obtaining data. Medical record information is of a confidential nature, and medical record librarians must be especially discreet in processing and releasing the information for legitimate use. Since the work is exacting and yet subject to frequent interruptions, the medical record librarian should be able to maintain standards of accuracy despite pressures. For persons aspiring to administrative positions, organizational and managerial skills and the ability to cooperate effectively with other departments and with hospital medical record committees are important.

Assignments to supervisory work, primarily in large facilities, afford advancement opportunities for medical record librarians. In a large medical record department, the head medical record librarian may be responsible for the work of other medical record librarians and for a staff of typists, surgical secretaries, file clerks, and clerical workers.

Employment Outlook

There is an acute shortage of medical record personnel in all sections of the United States and in both private and government medical care institutions. Many persons at both librarian and technician levels are needed in general and specialized hospitals. There is increasing need for record personnel in specialized fields of research and to assume administrative and training responsibilities.

Many new positions will be created as hospital and other medical facilities expand and increase in number and as the work of medical record departments becomes more extensive and more complex. The importance of medical records is being augmented by rapidly growing demands for clinical data in research on cancer, arthritis, and heart and other diseases, and on the use of new drugs and other methods of treatment. Research on mental diseases has revealed a need for the development of in-patient record systems in mental hospitals. Special interest in our aging population will necessitate the recording, and periodic summaries, of the condition of patients with extended illnesses, including chronic and intervening illnesses. Additional trained workers will be needed because of the expanding scope of public health responsibilities and a growing need for centralized information.

It is anticipated that opportunities for medical record librarians will be excellent far in the 1960's. The American Association of Medical Record Librarians estimated that, as of December 1958, there were actual vacancies for 2,000 to 3,000 additional registered medical record librarians and a need for 8,000 to 10,000 more technical and clerical workers.

Earnings and Working Conditions

Salaries are related to the geographic location, size, and type of the institution by which medical record librarians are employed, as well as to the nature and responsibility of the position involved.

Average weekly straight-time salaries ranging from $68 to $86.50 for women medical record librarians were reported by the U.S. Department of Labor following a survey of hospital employees in 16 metropolitan areas in 1956 and early 1957. The average salary reported was higher in most cities than that received by women physical therapists, head nurses, general duty nurses, medical technologists, nonsupervisory dietitians, and X-ray technicians.

In early 1959, possible entrance salaries for inexperienced medical record librarians who have completed degree or certificate programs were estimated, by persons in the profession, to be as high as $4,800 a year. Annual entrance salaries for technicians with 1 year of training in medical record library science were estimated to range from $3,200 to $3,500.

Yearly salary scales established for those entering Federal employment, including the commissioned corps of the Public Health Service, ranged in 1959 from $4,040 to $8,330, depending upon the amount and type of education and experience required.

Medical record librarians work the hours scheduled for the majority of professional and technical employees at the same places of employment. In the 16 areas surveyed, a 40-hour workweek was most common. Vacations with pay, of at least 2 weeks' duration, were usually granted after a year of service, and longer vacations were often granted to persons with longer service. The number of paid holidays varied from 5 to 11.

Working conditions are generally pleasant, although increasing complexity of the work of medical record departments and the growing accumulation of records has resulted in crowded conditions in some hospitals. The use of automatic devices, such as electrically operated files, electric typewriters, photostatic equipment, and intercommunication systems is increasing.

Where To Go for More Information

Information about approved schools and employment opportunities may be obtained from the following organization:

American Association of Medical Record Librarians, 840 North Lake Shore Dr., Chicago 11, Ill.

Occupational Therapists*

(D.O.T. 0–32.04)

Nature of Work

Occupational therapists organize educational, prevocational, and recreational programs to assist in the physical, psychological, and economic rehabilitation of injured and disabled persons.

After a physician makes his diagnosis and outlines treatment objectives for a patient, occupational therapists select and direct activities which will best meet the patient's needs. These activities may include such traditional manual and creative arts as weaving, clay modeling, or leather work. Business and industrial skills, such as typing, operation of a key punch machine, typesetting, and use of power tools are also employed in therapy programs.

Training in activities of daily living to aid the handicapped in obtaining maximum self-sufficiency is an important part of rehabilitation. This may involve teaching the disabled patient how to care for his own personal grooming needs, and how to perform such common motions as opening doors, turning on lights, using a telephone, and so forth. The disabled housewife may be trained to care for her children and perform normal household tasks. The occupational therapist sometimes makes equipment such as splints for the patient's use in these activities.

Planning of recreation programs, including parties, games, and cultural activities, is sometimes part of the occupational therapist's duties

Occupational therapist helping restore strength to arm and finger muscles of young polio patient.

*Prepared by the Women's Bureau, U.S. Department of Labor.

in organizations which do not employ recreational therapists.

Occupational therapists may supervise occupational therapy assistants who teach a particular skill, volunteer workers, and student therapists. Some occupational therapists have administrative duties as directors and assistant directors of an occupational therapy program; some specialize in working with various disabled groups; others may serve as directors or teachers in approved schools of occupational therapy.

Where Employed

More than 6,000 occupational therapists were registered with the American Occupational Therapy Association in November 1958. An additional 1,000 to 2,000 practicing occupational therapists were not registered because they had not applied for registration, had allowed their registration to lapse, or were college graduates with majors in related subjects, but not graduates of schools of occupational therapy approved by the Council on Medical Education and Hospitals of the American Medical Association.

The great majority of occupational therapists are women. However, men are entering the field because of increasing salaries, interest resulting from observation of occupational therapy in military service, and availability of training under GI bill benefits.

Most occupational therapists work in hospitals and other health institutions, such as school clinics, sanitoriums, and some homes for the aged. Almost all of the remainder work in special workshops or rehabilitation centers to which patients come for treatment. These centers are sponsored by hospitals, religious organizations, or such community agencies as associations for the blind, the deaf, or the cerebral palsied. A few occupational therapists are employed in home-visiting programs for patients unable to go to clinics or workshops.

The greatest number of occupational therapists work in programs for psychiatric patients and persons with physical disabilities (including cerebral palsy and tuberculosis). The remainder work in such fields as pediatrics, general medicine and surgery, education for occupational therapy, and geriatrics.

Training, Other Qualifications, and Advancement

Graduation from an approved school of occupational therapy is a general requirement for entry into the profession and necessary for entrance to the national registration examination conducted by the American Occupational Therapy Association. Persons who successfully complete the examination may use the initials O.T.R. (Occupational Therapist Registered) after their names.

In 1958, 29 approved colleges or universities offered courses in occupational therapy. In addition, courses were offered by three new schools whose accreditation will become final upon graduation of their first classes and final approval by the A.M.A. For high school graduates, this training includes 4 years of college work plus 9 months of supervised practice in hospitals and health agencies, leading to a bachelor of science degree with a major in occupational therapy. The majority of these schools also accept college graduates with training in other fields who may earn a certificate in occupational therapy following 18 months of specialized training.

Tuition ranges from $60 to $1,100 a year, with half of the schools charging under $300 a year. A number of scholarships are available through individual schools of occupational therapy; fraternal, service, and civic organizations; and private and governmental health agencies.

A few colleges and health agencies offer advanced courses in special disabilities, such as cerebral palsy and poliomyelitis, for graduates of approved schools.

Occupational therapists without experience begin as staff therapists and may qualify as senior therapists after 2 years on the job. Experienced therapists may become directors of occupational therapy programs in large hospitals, clinics, or workshops, or teachers in occupational therapy schools. There are also some key positions as coordinators of physical medicine programs, and as consultants with large institutions and agencies.

Personal characteristics needed in this occupation are emotional stability and physical stamina, a genuine liking for people, a sincere interest in medical work, and a sympathetic but objective approach to illness and disability.

Employment Outlook

Opportunities for qualified occupational therapists are expected to be excellent well into the 1960's.

Since World War II, the demand for occupational therapists has been increasing, due to growing public interest in the rehabilitation of all disabled persons and the demonstrated success of occupational therapy programs in restoring people to health. Furthermore, increasing use is expected to be made of occupational therapists in treating illnesses and disabilities arising from industrial accidents, as well as in treating victims of cerebral palsy, poliomyelitis, and heart disease. Anticipated expanded use of occupational therapy in treating persons suffering from mental illnesses and in rehabilitating the disabled and infirm among the growing number of aged persons will also increase the demand for therapists.

Opportunities for men are especially good in mental hospitals, veterans' facilities, and other types of rehabilitation centers.

In addition to the new positions created by increasing demand, many job openings will result from turnover. In 1958, the number of job opportunities was estimated to be more than double the number of trained workers. The American Occupational Therapy Association forecasts that 15,000 additional occupational therapists will be needed by 1961.

In order to meet the expanding demand, more students are being encouraged to enter training. Although additional schools are needed in some areas, particularly the South, not all of the existing schools were filled to capacity during the 1957–58 academic year. Only 2,060 students were enrolled in approved schools that year—a decrease of more than 400 from the 1956–57 enrollment. Even if schools were filled, however, the supply of graduates would be insufficient to meet the rising demand.

Earnings and Working Conditions

Salaries of occupational therapists ranged from approximately $4,000 to $10,000 in 1958, according to the American Occupational Therapy Association. Staff therapists were paid salaries of $4,000 to $4,500 a year, while senior therapists reported earnings of $4,500 to $5,300. Directors of occupational therapy programs received from $5,500 to $7,000 a year, and a few coordinators or consultants earned between $6,000 and $10,000 a year. The beginning salary in the Federal Government in 1958 for occupational therapists without experience was $4,040 a year; and those with at least 1 year of experience started at $4,980.

Most institutions operate on an 8-hour day, 40-hour week, with some evening work required in organizations where the occupational therapy department handles the recreation program. Vacation leave for therapists ranges from 2 to 4 weeks annually. Many positions now offer health and retirement benefits.

Where To Go for More Information

Additional information on occupational therapy is available in a U.S. Department of Labor's Women's Bureau publication, The Outlook for Women as Occupational Therapists. Bulletin 203–2, Revised. Washington, D.C. 1952. Price 20 cents.

Detailed information on the field, on colleges offering approved programs, and on scholarships can be obtained from:

American Occupational Therapy Association,
250 West 57th St., New York 19, N.Y.

506397 O—59——8

ENGINEERING

Engineering, the second largest professional occupation, is exceeded in size only by teaching; for men, it is the largest profession. The approximately 850,000 engineers in the United States in 1958 contributed greatly to designing, building, and planning the work of the machines, equipment, roads, and buildings used by the Nation's 174 million people. Engineers provide technical and, frequently, managerial leadership in industry. They develop new products and processes, design many types of structures, devise the most efficient ways of extracting minerals from the earth, and contribute in countless other ways to the technological progress of civilization and to the national defense.

Nature of Work

Engineers are concerned with transforming natural resources into forms useful to mankind and with doing this in the most efficient manner possible. This emphasis on efficiency, which is closely related to cost, is one of the main factors which distinguishes the work of most engineers from that of most scientists. A chemist may create a new compound or a geologist may discover an oil field. The engineer must determine how the compound can be manufactured or the oil extracted at a cost low enough to be sold on the market. In constructing a large building, for example, it might be possible to insure safety by making the walls of solid masonry 20 feet thick, but it is much more efficient and less expensive to have an engineer calculate just how much weight the walls will have to bear, what other forces will affect them, and what margin of safety must be allowed. The engineer has to decide which building materials would be the best to use, taking into consideration their relative strengths and durability, their cost, the quantities needed, and the cost of the labor required in their installation and upkeep. Similar factors must be considered by engineers developing and designing such diverse products as electronic equipment, home appliances, and diesel locomotives.

In addition to developing and designing new and improved products, engineers perform various other types of work. Their knowledge and skill is used in administration and management, particularly in aircraft, electronics, and other industries where engineering methods are of great importance. Many supervise construction activities or the operation of plants and mines. Others do research, aimed at providing the information needed for the development of new products or methods of manufacture. Some, particularly trainees or beginning engineers, do drafting, analysis, or testing, much of which is routine work. A sizable number work for consulting firms or as independent consultants, who advise their clients on engineering matters. Many companies employ engineers to sell their products, particularly when the salesman must be able to discuss the technical aspects of the product and assist in planning its installation and use. A relatively small but exceedingly important group of engineers teach in colleges, universities, or other engineering schools.

Most engineers specialize in one of the many branches of the profession, although there is a trend away from specialization in the early phases of training and career development. At least 20 specialties are recognized in practice and in engineering school curriculums. Several of these—aeronautical, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining engineering—are discussed separately later in this chapter. (Agricultural engineering is discussed separately under the chapter on Agricultural Occupations. See index for page number.) Work in each of these areas involves specialized knowledge, but there is a considerable body of basic knowledge and methodology which is common to most areas of engineering. Thus, engineers are often able to shift from one branch to another, particularly in the early stages of their careers.

Engineers may also become specialists in a particular technology, such as nuclear engineering, or in the engineering problems of a particular industry. In many instances, these specialties cut across the traditional branches. Nuclear engineers, for example, frequently have considerable academic training in physics and mathematics and often graduate training in nuclear engineering, but their bachelor's degrees are usually in chemical, mechanical, or one of the other traditional branches of engineering.

Where Employed

The majority of engineers—almost three-fourths of the total number in 1958—are employed in private industry. Virtually all manufacturing industries employ some engineers. Those employing the largest numbers are the electrical equipment, aircraft and parts, and machinery industries. Other industries which employ sizable numbers of engineers include motor vehicles, transportation and other public utilities, construction, chemicals and allied products, petroleum, telecommunications, fabricated metal products and ordnance, professional and scientific instruments, and primary metals.

Another large group of engineers—more than 15 percent of the 1958 total—are employed by Federal, State, and local government agencies. Estimates of the proportions of engineers in still other types of employment are: Engineering and architectural services (including self-employed), about 5 percent; military (active duty), about 3 percent; and educational institutions, about 2 percent. The remaining small group is in a variety of other areas of employment, including independent commercial laboratories and nonprofit organizations.

Engineers are employed in every State, in small cities as well as large. The profession also offers opportunities for employment overseas. However, some branches of engineering are concentrated in particular industries or geographic locations (as indicated in the statements on the various branches later in this chapter).

Training and Other Qualifications

Four years of college work leading to a bachelor's degree in engineering is usually the minimum educational requirement for engineering work. Some engineers, however, have entered the profession with training in physics, or one of the other natural sciences, or mathematics. Others have been able to enter the field without degrees but only after long experience as semiprofessional workers—such as draftmen and engineering technicians—and some college-level training. The proportion of engineers with advanced degrees is still small in most branches of the profession, but graduate training is being emphasized in the selection of personnel for an ever-increasing number of jobs. Furthermore, training in some engineering specialties, such as nuclear engineering, is available almost exclusively at the graduate level.

It is important for prospective engineering students to select an accredited school of engineering, since persons trained at such schools generally have the best employment opportunities. Of the 226 universities and engineering schools which in 1958 offered training in engineering leading to a bachelor's or a higher degree, 153 had curriculums which were accredited by the Engineers' Council for Professional Development.

In the typical 4-year engineering curriculum, the first year and part of the second are devoted to basic preengineering subjects such as mathematics, chemistry, and physics, and to courses in the liberal arts—the humanities, social sciences, and English. The last 2 years are devoted mostly to engineering and advanced mathematics and science subjects, with some differences in courses depending on the branch of engineering in which the student is specializing.

Not all engineering courses, however, are completed in 4 years. Some institutions have 5-year programs leading to the bachelor's degree, and a number of engineering schools have arrangements with liberal arts colleges whereby a student spends 3 years in the liberal arts college and 2 years in the engineering school and receives bachelor's degrees from both. About 35 institutions have cooperative plans under which students spend alternate periods in attendance at college and in employment in industry or government. Under such plans, the normal 4-year curriculum is spread over 5 and sometimes 6 years, but the graduate has the advantage of about 2 years of experience in addition to his engineering degree.

With the rapid developments in science and engineering, many employers in recent years have stressed the need for engineers with a particularly strong background in mathematics and the basic sciences. Therefore, persons contemplating an engineering career should take as many mathematics and science courses as possible in high school, and should continue to obtain extensive training in these subjects in college. There is also a demand for engineering graduates with broad training in other subjects, including the social sciences and the humanities. Furthermore, many employers emphasize the extra-curricular college record of prospective employees.

Beginning engineers usually enter as trainees or in the more routine jobs. Some industrial employers have special training programs for their beginning engineers; these programs are designed to supplement college work with training in specific industrial techniques and to aid in determining the type of work for which the individual is best suited. With experience, engineers frequently move up to positions of greater responsibility. Those with ability and interest can advance to high-level technical, supervisory, and administrative jobs and even to top executive positions.

Laws providing for licensing (or registration) of professional engineers whose work may affect life, health, or property are in effect in all States, Territories, and the District of Columbia. Although the various State laws have different provisions as to the types of work for which registration is required, nearly all States provide registration for all of the major branches of engineering. In 1958, about 227,000 engineers were registered under these laws in the United States and Territories.

Registration laws are subject to frequent change and improvement. Generally, requirements for registration as a professional engineer are: Graduation from an accredited engineering college, plus 4 years of experience, and passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

Employment Outlook

The outlook is for continued expansion of the engineering profession both in the early 1960's and over the long run. Engineering has been one of the fastest-growing professional occupations in the United States in the past 50 years. The demand for engineers increased particularly rapidly after World War II—especially after the outbreak of hostilities in Korea in 1950, when the needs of the expanded defense program were added to those of the growing civilian economy. The profession continued to expand rapidly throughout the late 1950's, despite the economic recession in late 1957 and early 1958 and the cancellation of Government defense contracts in some industries.

There is every indication that the demand for engineers will go on increasing rapidly. Some of the major factors expected to raise the demand for engineering personnel are: Continued high levels of Government spending for defense; growth of population and expansion of industry; increasing complexity of industrial technology as, for example, the trend toward automation of industrial procedures; and further growth in expenditures for research and development. The large sums spent for research and development in recent years by both industry and Government have broadened existing areas of employment for engineers and opened up new ones, such as computer technology, rocketry, and nuclear energy. As scientific frontiers are further extended, additional areas of work for engineers will be provided. In addition, the rise in engineering enrollments anticipated during the 1960's in colleges and universities will result in many openings in teaching. (See statement on College and University Teachers. Refer to index for page number.)

Aside from the engineers needed to fill new positions, thousands will have to be trained annually to replace those who retire, die, or transfer to other occupations. Losses to the profession from retirements and deaths alone were estimated to be more than 10,000 a year in 1958 and were expected to rise slowly in the future.

Along with the expected growth in demand for engineers, an increase in the number of engineering graduates is anticipated. In 1958, 35,332 bachelor's degrees in engineering were conferred, more than were granted in any year since 1950 (53,000). If the proportion of college graduates majoring in engineering remains the same as in recent years, the number of bachelor's degrees conferred in engineering will continue to rise slowly in the early 1960's and more rapidly thereafter. By the late 1960's or early 1970's the number may be more than double the number conferred in 1958, according to estimates by the

U.S. Office of Education. Despite this increase, it is expected that employment prospects for engineering graduates will continue to be favorable through the early 1960's, at least.

This conclusion is based on the assumption that the Nation's economy will continue to expand. It also assumes that Government spending for defense, including research and development—a major factor affecting demand for engineers—will remain high. If Government spending for these purposes should drop, the demand for engineers would decrease. On the other hand, a substantial increase in defense expenditures or an acceleration in other Government programs such as public works would intensify the demand for engineering personnel.

For the student, the anticipated rapid growth in engineering enrollments may mean increasing difficulty in entering the engineering school of his choice. Unless facilities and teaching staffs are greatly expanded, colleges and universities may not be able to accommodate all students wishing to enter engineering schools, and some institutions may raise entrance standards. In any case, adequate preparation and a realistic appraisal of aptitude for engineering work are of utmost importance to a young person looking forward to an engineering career. Moreover, in recent years industry officials have continually stressed the need for high-quality men as a more pressing problem than that of inadequate numbers of graduates. Even under favorable employment conditions the marginal student may not advance far up the professional ladder. On the other hand, there is every reason to believe that the demand for engineering graduates with ability and thorough training will remain high for many years to come.

Employment opportunities for women engineers, who represent only a very small proportion of the profession, are also expected to be favorable through the early 1960's. Furthermore, there has been a recent trend for employers to eliminate salary and other employment differences between men and women engineers of comparable education and experience who are doing similar work.

The foregoing analysis relates to the outlook for the engineering profession as a whole. The differences in employment outlook among the various branches of engineering are discussed in the statements on these branches later in this chapter.

It should be noted that no estimate of the future supply of personnel in each branch is included in these statements. Such estimates are difficult to make for a number of reasons. In the first place, the numbers of students majoring in the various branches of engineering depend not only on the numbers of young people of college age and the degree of interest in the engineering profession but also on many special factors, such as the availability of training facilities and the relative employment situation in the various branches at the time the student decides which branch to enter. Moreover, graduates with a degree in one field of engineering often find employment in another. This mobility of personnel is one of the reasons why differences in the employment situation between the various fields of engineering are likely to be moderate, at least among the younger members of the profession.

Earnings

The median yearly salaries of new engineering graduates with bachelor's degrees and no experience are shown in the following tabulation, based on a survey made by the Engineers Joint Council in the summer and fall of 1958.

Industry	Median [1]	Upper decile [2]	Lower decile [3]
Advanced weaponry	$5,875	$6,725	$5,500
Aircraft manufacturing	6,325	6,950	5,625
Chemical	6,075	6,600	5,675
Electrical machinery and electronic manufacturing	6,200	7,400	5,575
Fabricated metal products	5,625	6,350	5,100
Instrument manufacturing	5,850	6,425	5,275
Machinery manufacturing (except electrical)	5,825	6,675	5,325
Petroleum industry	5,875	6,375	5,475
Design services and construction	5,925	6,750	5,175
Telecommunications (operations)	5,350	6,175	4,925
Utilities (electric, electric and gas)	5,575	6,125	4,950
Miscellaneous services:			
Consulting	5,700	6,400	4,350
Research and development	6,000	6,875	5,550
Government (other than Federal):			
State highway commissions	5,575	6,250	5,100
Local governments	5,675	6,500	4,900

[1] 50 percent earned more; 50 percent earned less than amounts shown.
[2] 10 percent earned more than amounts shown.
[3] 90 percent earned more than amounts shown.

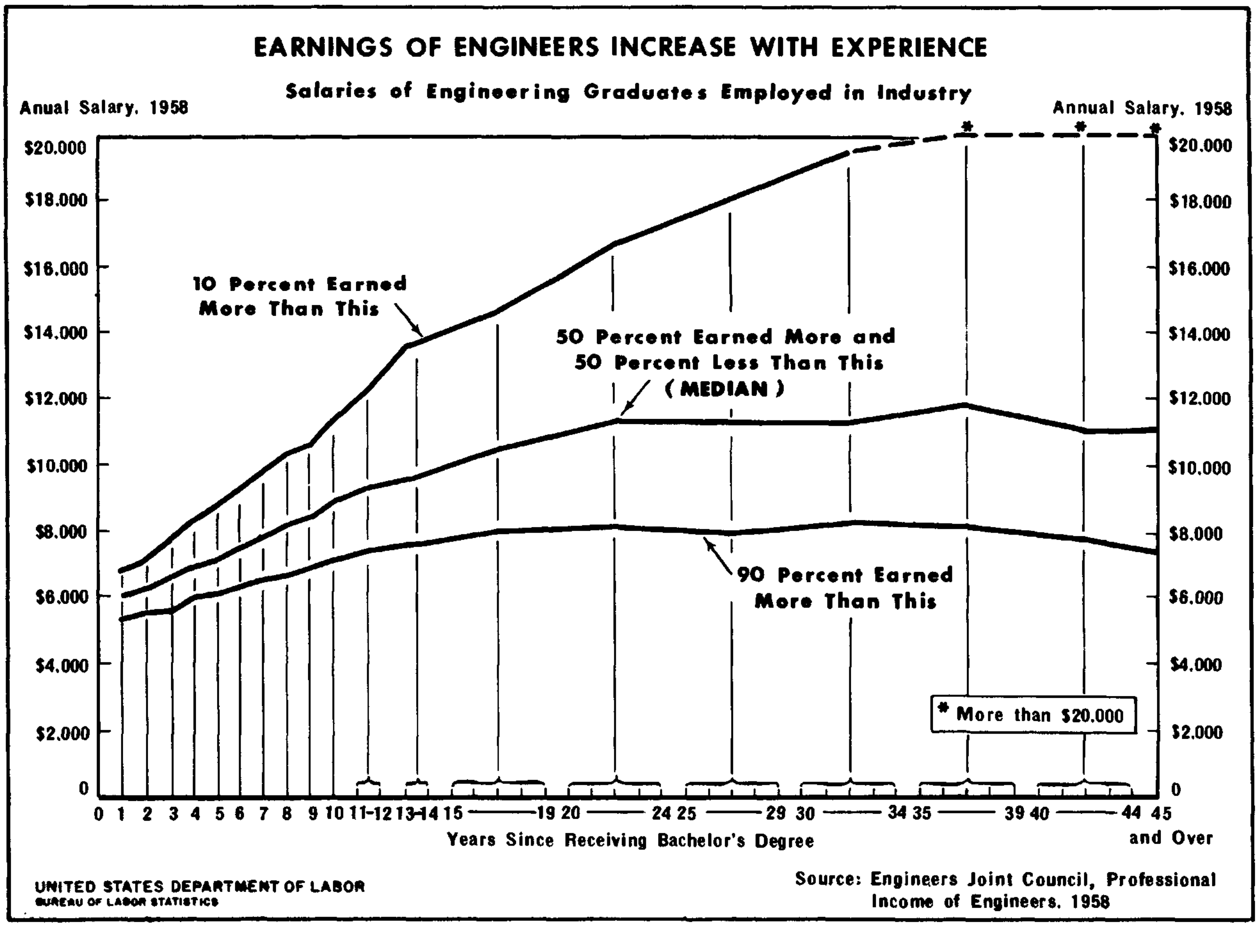
New engineering graduates with master's degrees and no experience usually received approximately $600 to $1,200 a year more than those with only bachelor's degrees. Salaries for new graduates with doctor's degrees typically ranged from about $7,500 to more than $10,000 a year.

In the Federal Government, the beginning salary in 1958 for engineers with the bachelor's degree and no experience was either $4,490 or $5,430, depending on their college record. Beginning engineers with one full year of graduate study could begin at $5,430; those with two full years, at $6,285. New graduates with the Ph. D. were eligible to begin at $7,510. In addition, the salary schedule calls for periodic increases above these base salaries.

Most engineers can look forward to a rapid increase in earnings as they gain experience. Thus, in industry, the median yearly salary of engineers with 10 years of experience was about $9,250 in 1958, and that of engineers with 20 years of experience was about $11,200 (chart 19). Nearly all (90 percent) of the men with 20 years of experience had earnings of at least $8,100 a year and a few (10 percent) earned $16,100 or more. A small number in top-level executive positions had much higher earnings.

In general, earnings of engineers are higher in private industry than in other types of employment. Though engineers in Government employment generally earn less than those in private industry, particularly in top-level jobs, their salaries tend to be higher than those of engineering educators. On the other hand, engineers in educational institutions can frequently supplement their salaries with income from special research projects, consulting work, publications, or employment during their vacations.

CHART 19



Where To Go for More Information

General information on engineering careers—including student selection and guidance, professional training and ethics, salaries and other economic aspects of engineering—may be obtained from:

Engineers Council for Professional Development,
29 West 39th St., New York 18, N.Y.

Engineers Joint Council,
29 West 39th St., New York 18, N.Y.

National Society of Professional Engineers,
2029 K St. NW., Washington 6, D.C.

Information on engineering schools and curriculums and on training and other qualifications needed for entrance into the profession may also be obtained from the Engineers Council for Professional Development; and information on registration of engineers, from the National Society of Professional Engineers.

Organizations which can furnish information on the respective branches of engineering are listed below:

American Ceramic Society,
4055 North High St., Columbus 14, Ohio

American Institute of Chemical Engineers,
25 West 45th St., New York 36, N.Y.

American Institute of Electrical Engineers,
33 West 39th St., New York 18, N.Y.

American Institute of Industrial Engineers,
145 North High St., Columbus 15, Ohio

American Institute of Mining, Metallurgical and Petroleum Engineers,
29 West 39th St., New York 18, N.Y.

American Society of Civil Engineers,
33 West 39th St., New York 18, N.Y.

The American Society of Mechanical Engineers,
29 West 39th St., New York 18, N.Y.

Institute of the Aeronautical Sciences, Inc.,
2 East 64th St., New York 21, N.Y.

The above list includes only some of the many engineering organizations. Other engineering organizations are listed in the following publications available in most libraries:

Engineering Societies Directory, 1956, published by Engineers Joint Council

Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council

Some engineers are members of unions. Information on engineering unions may be obtained from:

The American Federation of Technical Engineers (AFL–CIO),
900 F St. NW., Washington 4, D.C.

Engineers and Scientists of America (Ind.)
Munsey Bldg., Washington 4, D.C.

See also statement on Agricultural Engineers. (Refer to index for page number.)

The U.S. Civil Service Commission, Washington 25, D.C., will furnish information on positions available in Federal Government agencies. For further information, see chapter on Government Occupations.

Aeronautical Engineers

(D.O.T. 0–19.03)

Nature of Work

Aeronautical engineering is a relatively new and rapidly growing branch of the profession. Engineers in this branch are concerned with all phases of the research, planning, development, design, manufacture, and testing of all types of air- and space-craft and their parts and equipment.

Aeronautical engineers usually specialize in some particular area of work, such as structural design, aerodynamics, armament, electronics, propulsion systems, or production methods. Frequently, their specialization also extends to particular types of aircraft, such as commercial or military planes, rockets, or guided missiles.

Where Employed

Most aeronautical engineers are employed by the aircraft and related industries. The largest numbers of these engineers are in the airframe industry, but many are employed by engine and parts manufacturers. Some aeronautical engineers work for Federal Government agencies, principally the Department of Defense and the National Aeronautics and Space Administration. Small numbers work for commercial airlines, colleges and universities, and other types of employers.

Employment in this branch of the engineering profession is concentrated in the States where most aircraft plants are located—chiefly California, Ohio, New York, Connecticut, Texas, Washington, Kansas, Maryland, Indiana, and New Jersey. (For more information on the airframe, and engine and parts industries, refer to the chapter on the Aircraft, Missile, and Spacecraft Field. See index for page number.)

Employment Outlook

The outlook is for continued rapid expansion of employment in aeronautical engineering, both in the early 1960's and over the long run. In recent years, the demand for these engineers has grown rapidly, largely as a result of the growing emphasis on airpower for national defense since the Korean emergency and the consequent enormous expansion of the aircraft and missile industry. Assuming that Government expenditures for aircraft, missiles, and related items continue to increase as expected, the aircraft industry will probably continue to grow. Moreover, the need for intensive research and development aimed at replacing obsolescent aircraft, first with improved types of aircraft and later with missiles, will require additional aeronautical engineers. The increasingly complex designs of airplanes and guided missiles, requiring more and more engineering time to design and build, are expected to increase further the demand for aeronautical engineers in future years. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Ceramic Engineers

(D.O.T. 0–15.11)

Nature of Work

Ceramic engineers apply scientific and engineering principles to the processing of clay, silicates, and other nonmetallic minerals, and to their manufacture into a wide variety of ceramic products, ranging from cement and bricks to spark plugs and dentures. They may also design and supervise the construction of the plant and equipment used in the manufacture of these products. About one-third of the ceramic engineers are engaged in research and development work. Another one-third are employed in administration and management. Others are employed in plant operations, selling, or teaching, and a small number do consulting work.

Ceramic engineers usually specialize in one or more products—for example, refractories (fire- and heat-resistant materials, such as firebrick); whiteware (such as porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile, and terra cotta); glass; enameled metals; abrasives; and cements, limes, and plasters.

Where Employed

Most engineers in this branch are employed in private industry. The largest numbers are in the stone, clay, and glass industries, but others work in the iron and steel, electrical machinery, chemical, and other industries which produce or use ceramic products. Some are employed by educational institutions and by other organizations. A small number work for government agencies, chiefly those of the Federal Government. A large proportion of all ceramic engineers are employed in Ohio, Pennsylvania, New York, New Jersey, Illinois, and California.

Employment Outlook

Ceramic engineering is one of the smaller branches of the profession, and opportunities for new entrants in any one year are relatively few. Nevertheless, in recent years there has been a strong demand both for new graduates and for persons with experience in ceramic engineering.

Employment in ceramic engineering is expected to continue to grow, both in the early 1960's and over the long run. Increasing use of glass, enameled metals, whitewares, abrasives, and other ceramic products will require additional ceramic engineers for research and design work to adapt these products to various needs. The increasing use of cement and structural clay products in construction will also add to the opportunities for ceramic engineers. Newer areas of work in nuclear energy, electronics, and jet and rocket propulsion will, likewise, provide additional opportunities for these engineers. For example, the development of ceramic coatings which are corrosion-resistant and capable of withstanding extremely high temperatures has played an important role in the development of jet engines and nose cones for long range guided missiles. Problems posed by the development of aircraft and rockets capable of still higher speeds and greater altitudes will increase further the demand for ceramic engineers as well as for other engineers and scientists. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Chemical Engineers

(D.O.T. 0–15.01)

Nature of Work

Chemical engineers translate the discoveries made in chemical laboratories into large scale commercial production. They are primarily concerned with the design and operation of the plants and equipment and with other engineering work required in the utilization of chemical processes on an industrial scale. A chemical process may consist of a combination of "unit operations"—mixing, crushing, grinding, crystallization, heat transfer, distillation, and drying—and chemical operations—oxidation, hydrogenation, chlorination and polymerization. The chemical engineer determines the combination of these operations which will result in the most effective manufacturing process.

Because of the great complexity of these manufacturing processes, the chemical engineer frequently becomes a specialist in a particular type of operation (for example, heat transfer, distillation, or drying) or in the products of one industry (for instance, petroleum, plastics, rubber, food, or industrial chemicals). The activities in which chemical engineers are chiefly engaged are research and development, plant operation, design, and management.

Where Employed

A great many industries use chemical engineers. However, most are employed by manufacturing firms—chiefly in the chemical and petroleum industries. Some are employed in government agencies, in consulting firms or as independent consulting engineers, and in college teaching.

Chemical engineers are employed to some extent in all States, mainly in or around large industrial areas. The largest numbers are in New York, New Jersey, Pennsylvania, Ohio, California, Illinois, and Texas.

Employment Outlook

Chemical engineering is one of the youngest of the major fields of engineering, and has grown rapidly in the past few decades. In recent years, demand for these engineers has been particularly heavy, largely as a result of the rapid expansion of the industries in which most chemical engineers are employed (chiefly chemicals and petroleum) and of the tremendous growth of research and development in these industries.

The outlook is for continued growth in this branch of engineering, both in the early 1960's and over the long run. The major factors which have contributed to the growth in past years will in all probability continue to be important in the future. In particular, the chemical and petroleum industries are expected to continue to expand rapidly. In these and other industries employing chemical engineers, including atomic energy, continued expansion of research and development activity (in which about one-third of all chemical engineers are employed) is expected to contribute to further growth of employment in the profession. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Civil Engineers

(D.O.T. 0–16.01)

Nature of Work

Civil engineering is the oldest branch of the engineering profession as we know it today. Historically, the profession had only two main branches, "military" and "civil." However, as technical knowledge expanded and industry became more complex, other fields of engineering developed. Today, civil engineers form one of the two largest of the many branches of the profession. They design and supervise the construction of roads, harbors, airfields, dams, tunnels, water-supply and sewage systems, transportation facilities, buildings, and many other types of structures. The civil engineering field is so broad that many specialties have developed within it—the major ones being structural, highway, hydraulic, railroad, sanitary, and public health engineering.

A sizable proportion of all civil engineers are in supervisory or administrative positions, ranging from that of site supervisor of a construction gang or head of a drafting department to top-level executive posts. Many are also employed in design and related activities.

COURTESY OF U.S. BUREAU OF RECLAMATION

Civil engineer inspecting reinforcing steel used in the construction of a river basin project.

Where Employed

About half of all civil engineers are employed by Federal, State, and local government agencies. The second largest group are in the construction industry. In addition, many are employed by consulting engineering firms or work as independent consulting engineers. Others work for public utilities; for railroads; for banking, finance, insurance, and real estate firms (in such work as appraisal of properties); and in educational institutions. Still others are employed in the iron and steel industries and other branches of manufacturing.

Civil engineers work in all parts of the country, in every State and city. The largest numbers are located in or near the large industrial and commercial centers. However, since civil engineers are frequently called upon to work at construction sites, they are sometimes stationed in remote areas of the United States or in foreign countries. Furthermore, they are often required to move from one place to another to work on different projects, although many civil engineering positions involve little or no travel.

Employment Outlook

Employment in civil engineering is expected to grow, both in the early 1960's and over the long run, although not as rapidly as in electrical and mechanical engineering, the other large branches of the profession. Construction activity, including not only housing and industrial building but also water and sewage systems, is expected to have an upward trend for many years as a result of population growth and the expansion of the Nation's economy. The enormous highway construction program voted by Congress in 1956 will also create some new jobs for civil engineers during the early 1960's. In addition, large numbers of civil engineers will be needed each year to replace those leaving the field. Civil engineers have a higher average age than members of any other branch of the profession, and consequently a higher rate of retirements and deaths. The number of civil engineers needed to replace men thus lost to the profession was estimated at approximately 2,800 a year in 1958, and will probably rise slowly in the future. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Electrical Engineers

(D.O.T. 0–17.01 and .02)

Nature of Work

Electrical engineers are concerned with the generation of electricity and its transmission and use. They design, develop, and supervise the manufacture of electrical and electronic equipment—including electric motors and generators; radio, television, radar, computers, missile guidance systems, and other electronic apparatus; and electrical appliances of all kinds. They also participate in the design and operation of facilities for generating and distributing electric power.

The major areas of work in this branch of engineering include electronics, electrical machinery and equipment manufacturing, telephone and telegraph, power, illumination, and transportation. Electrical engineers usually specialize in one of these broad areas of work or even in a subdivision of some one area. Radio engineering, for example, is an electronics specialty although it has become recognized as a distinct branch of the profession.

A sizable proportion of all electrical engineers are engaged in design, development, and research. Another large group are employed in technical administration. Others are employed in manufacturing operations or in technical sales.

Where Employed

Electrical engineers are chiefly employed by electrical and electronic equipment manufacturers, and by electric light and power, telephone and telegraph, and radio and television broadcasting companies. However, many members of this profession are employed in other industries, and some are employed in government agencies, consulting firms or as independent consulting engineers, and in college teaching.

Employment in this branch of the profession is concentrated to a considerable extent in the industrial centers where electrical and electronic equipment is manufactured. However, jobs with electric light and power companies, telephone companies, and radio and television stations are located in every State—in small towns as well as large cities.

Employment Outlook

In the last few decades, electrical engineering has been among the most rapidly growing branches of the profession. Today, it is one of the three largest branches of engineering. Since the initiation of the defense program in mid-1950, the enormous military needs for new and improved types of electronic and electrical equipment have been a major factor in increasing the demand for electrical engineers. These defense needs, added to those of the expanding civilian economy, have resulted in a marked growth in the electrical equipment industry. Defense requirements have contributed especially to the tremendous increases in spending for research and development in this industry and hence to the demand for electrical engineers in research activities. There has also been rapid growth in the electric utility and the telephone and telegraph industries—other large fields of employment for electrical engineers.

The outlook is for further rapid growth of employment in this branch of the engineering profession both during the early 1960's and over the long run. The growth of the electrical equipment, electric light and power, and telephone and telegraph industries is expected to continue with the greater use of electrical and electronic equipment by the Armed Forces, by industry, and in homes. Moreover, newer areas of work such as atomic power generation, aviation electronics, guided missiles, computers, and automation will probably continue to require large numbers of electrical engineers as well as other engineers and scientists.

Besides those needed to fill new positions, a sizable number of electrical engineers will be required to replace personnel lost to the profession by retirement or death. The number needed to fill such vacancies was estimated to be approximately 2,000 a year in 1958, and will probably rise slowly in the future. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Industrial Engineers

(D.O.T. 0–18.01)

Nature of Work

Industrial engineers are concerned primarily with the efficient use of machines, materials, and personnel in manufacturing and other industries. They often specialize in such types of work as the planning of plant layout so that the work will flow efficiently from one step in the production process to the next, or the selection and design of machines and equipment to be used in manufacturing operations. Among their numerous other specialties are time, motion, and incentive studies; production methods and standards; cost control and records; quality control; safety engineering; and industrial relations.

Where Employed

A large proportion of all industrial engineers are employed in manufacturing industries. Others work in the construction and extractive industries, for utilities, and for the Federal Government. A number are employed by banks, mail-order houses, life insurance companies, and other large business organizations to improve the efficiency of clerical and other operations.

Employment in this branch of the profession is concentrated in the highly industrialized States, particularly New York, Illinois, Ohio, Pennsylvania, Michigan, and New Jersey. Opportunities also exist in the growing industrial centers of the Southern and West Coast States.

Employment Outlook

Employment of industrial engineers is expected to grow both in the early 1960's and over the long run. The continued rapid growth of the Nation's industries, the expansion of automated processes, and the increasing complexity of industrial operations are expected to increase the demand for personnel trained in this branch of engineering. Growing recognition of the importance of scientific management and safety engineering, and the role of industrial engineers in reducing costs and increasing productivity are expected to further stimulate demand for personnel in this branch of engineering. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Mechanical Engineers

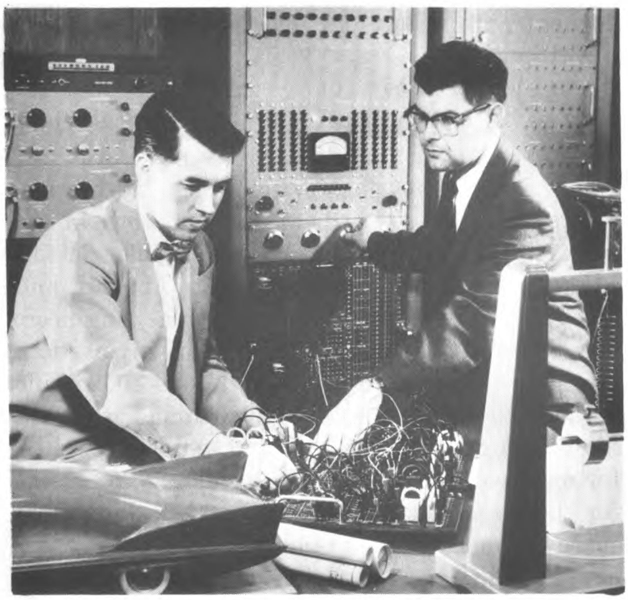
(D.O.T. 0–19.01, .05, .81, and .91)

Nature of Work

Mechanical engineering is one of the two largest branches of the profession. If aeronautical and industrial engineering, which are offshoots of this branch, were included with it, mechanical engineering would represent by far the largest branch of the profession.

Mechanical engineers deal primarily with machines, power, and heat. They develop and design machines, such as internal combustion engines, steam turbines, jet engines, and nuclear reactors, which produce power from fuels and other sources. They also develop a great variety of machines and devices which use power—refrigerating and air-conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others. Mechanical engineers often supervise the installation, operation, and maintenance of industrial machinery. Since virtually all industries use machines and require power, the work of the mechanical engineer underlies all kinds of industrial operations.

Because the field of mechanical engineering is so broad, many specialized areas of work have developed within it. Among them are motor vehicles, marine equipment, railroad equipment, steam power, heating, ventilating and air-conditioning, hydraulics or fluid mechanics, instrumentation, ordnance and machines for specialized



Research engineers using an analogue computor to simulate the effects of road conditions on a car's springs and other parts, and thus "proving out" the feasibility of new designs before these parts are manufactured.

industries, such as petroleum, rubber and plastics, and woodworking.

Where Employed

Mechanical engineers are employed in every major branch of manufacturing and in many nonmanufacturing industries. The largest numbers, however, are in the machinery, fabricated metal products, transportation equipment, iron and steel, and other metalworking industries. A number are employed in government agencies, educational institutions, and consulting engineering firms or as independent consulting engineers.

Though mechanical engineers are to be found in all parts of the country, the large majority are in nine States: New York, California, Ohio, Michigan, Illinois, Pennsylvania, New Jersey, Massachusetts, and Texas.

Employment Outlook

Mechanical engineering has been among the most rapidly growing branches of engineering in recent decades, particularly since World War II. The tremendous growth of the metalworking industries, stimulated by the mobilization program undertaken in mid-1950 and the defense program of more recent years, has resulted in a constantly increasing demand for mechanical engineers. The rapid expansion of research and development activities in these industries has also added to the demand for mechanical engineers' services.

The outlook is for further rapid growth in this branch of the profession both in the early 1960's and over the long run. The metalworking industries are expected to continue to expand. Moreover, newer areas of work, such as atomic energy, weapons development, and automation will probably provide additional openings for large numbers of mechanical engineers as well as for other engineers and scientists.

Besides those needed to fill new positions, sizable numbers of mechanical engineers are required each year to replace those who retire or die. Recent estimates placed this number at approximately 2,300 in 1958, and it will rise slowly in the future. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Metallurgical Engineers

(D.O.T. 0–14.10 and .20)

Nature of Work

Metallurgical engineers are concerned with the processing of metals and their conversion into commercial products. These engineers usually work in one of two main branches of metallurgy. The first of these, extractive metallurgy, deals with the extraction of metals from their ores, and with refining and related processes. The other branch, physical metallurgy, deals with the content and structure of metals and their alloys and with methods of converting refined metals into final products having a specified strength and hardness or other desired properties.

Persons working in the field of metallurgy are sometimes referred to interchangeably as metallurgists or metallurgical engineers. However, those known as metallurgists are likely to be engaged in such activities as research and development or analysis and testing; whereas, those with the title of metallurgical engineers are engaged mainly in directing the processing of ores.

Where Employed

Metallurgical engineers are employed chiefly in metalworking industries—especially in the iron and steel and nonferrous metals industries. The metal mining industry also employs substantial numbers. Small numbers hold positions in other industries, government agencies, consulting firms, research organizations, and educational institutions.

Most metallurgical engineers are in the large metal-fabricating centers of the country, mainly in Ohio, Illinois, Pennsylvania, Michigan, New York, and California. Those employed in the mining industry are naturally located chiefly in metal mining regions.

Employment Outlook

Metallurgical engineering is one of the smaller branches of the profession and opportunities for new entrants in any one year are relatively few. Nevertheless, in recent years there has been a strong demand both for new graduates and for persons with experience in metallurgical engineering.

Employment in this small branch of the profession is expected to grow rapidly, both in the early 1960's and over the long run. The metalworking industries will continue to expand, and increasing numbers of metallurgical engineers will be needed to work on problems involved in the adaptation of metals and alloys to specific needs. The development of such items as supersonic aircraft, jet engines, and guided missiles, for example, has created numerous new problems for the metallurgical engineer. Also, the atomic energy program has opened the door to a whole new field in the study of metals and their uses. As the supply of high grade ores is depleted, problems involved in processing low grade ores will further increase the need for metallurgical engineers. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

Mining Engineers

(D.O.T. 0–20.01 and .11)

Nature of Work

Mining engineers are responsible for the efficient extraction of minerals from the earth. They plan and supervise the construction of mine shafts and tunnels, devise means of extracting the minerals, and plan the methods to be used in transporting the minerals to the surface. Mining engineers also design and supervise the installation of water supplies, electric light and power facilities, and ventilation equipment in mines. They direct the operation of mines and are responsible for mine safety.

Some mining engineers work with geologists and other specialists in searching for ore-bearing rock or for deposits of petroleum, coal, or other minerals. When a mineral deposit is located, the mining engineer is often called upon to appraise its value.

Mining engineers frequently specialize in the extraction of a particular type of mineral—metals, coal, nonmetallic minerals, or petroleum and natural gas. (Petroleum engineering has become so specialized that it is rapidly becoming recognized as a separate branch of the profession.) Specialization of mining engineers may also extend to a particular type of work, such as mine safety, mine appraisal, or exploration.

Where Employed

Mining engineers are usually employed at the location of mineral deposits. They may work near small communities or in out-of-the-way places—in mountains or deserts. Those engaged in research, teaching, management, or consulting may, however, be located in large metropolitan areas. Large numbers are employed in Texas, Pennsylvania, West Virginia, Oklahoma, Louisiana, Kentucky, and California.

Employment Outlook

Since mining engineering is one of the smaller branches of the profession, opportunities for new entrants in any one year are relatively few. In recent years, employment prospects for new graduates with a degree in mining engineering have been less favorable than for those in most other branches of engineering. The best opportunities have been in the exploration field—for graduates with considerable training in geology, geophysics, and other aspects of exploration technology.

Mining engineering is expected to grow over the long run, although more slowly than most other branches of the profession. As needs for metals increase with the expansion of industry, and easily mined deposits are exhausted, mining engineers will be needed to devise ways of mining poorer deposits or those which are more difficult to work at a competitive cost. Additional areas of employment for mining engineers will arise as the development of new alloys and the discovery of new uses for metals increase the demand for the less widely used ores. In the petroleum industry, which has so far drawn chiefly upon the richer and more accessible oil fields, exploration crews including mining engineers with training in exploration technology will be needed to locate and exploit new oil fields, both in the United States and in other areas of the world. (See introductory section of this chapter for discussion on earnings and where to go for more information.)

PHYSICAL AND EARTH SCIENCES

Natural science—the sum of man's knowledge of the physical world and of the animals and plants in it—had its beginnings many centuries ago. At first, scientific knowledge was so limited that men of science did not need to specialize. Aristotle, for example, was familiar with all the science known in his day and was the author of books on both physics and animal life. Gradually, however, the body of scientific knowledge became too great for one individual to grasp in its entirety, and scientists became specialists in different fields.

Today, the natural sciences are customarily grouped into several broad categories: physical sciences—chemistry, physics, astronomy, mathematics; earth sciences—geology, geophysics, geochemistry, meteorology; and life sciences—including agricultural, animal, and plant sciences and microbiology. Furthermore, most scientists now specialize in subdivisions of these broad fields. Physicists, for example, are usually specialists in such areas as nuclear physics or optics; chemists, in such branches as organic or inorganic chemistry.

The trend toward finer subdivision of the sciences has, in recent years, gone hand in hand with a blurring of the lines between the different specialties. Information and techniques developed by scientists working in one field have often, with some new discovery, become the basis for the solution of problems in a different field. New specialties, such as geophysics and biochemistry, have come into being through a combination of the knowledge of two or more sciences. Thus, the total body of scientific knowledge is interrelated in many ways. No one branch of the natural sciences is entirely independent of all others. This chapter is, however, concerned chiefly with the physical and earth sciences. The biological sciences are discussed in the next chapter, and the agricultural sciences in the chapter on agricultural occupations.

It would be hard to exaggerate the importance of the natural sciences to the country's economic welfare and to the national defense. Nevertheless, they are relatively small fields of employment. The total number of scientists, including biological scientists, at all levels of professional training was about 300,000 in 1958, or about 1 scientist for every 230 workers in the labor force. Total employment in 1958 in the largest of the sciences—chemistry—was about 120,000.

Employment in the natural sciences has been increasing steadily. From 1930 to 1958, when the population as a whole increased more than 40 percent, the number of scientists increased more than 500 percent. A substantial part of this growth has occurred since the end of World War II.

The rapid growth in the demand for natural scientists is a reflection of scientific discoveries which have led to new and improved products and processes in a wide variety of industrial fields. Developments in recent years in aircraft and missiles, in television and radar, in atomic energy and associated technologies, and in a multitude of chemical products are among the best known examples, but they are only samples of a large number of uses of science in the production of necessities and conveniences for modern life. The sciences which have contributed most conspicuously to these developments are chemistry, physics, and mathematics. A number of life science specialties have also played important roles.

Some scientific specialties, such as astronomy and certain branches of mathematics, are still chiefly in the academic realm, with colleges and universities providing most of the employment opportunities. For many of the natural science professions, however, large fields of employment have opened up in the laboratories of business and government during the past four decades. After World War I, developments in the science of chemistry formed the basis for a rapid growth of the chemical industry, and a consequent great expansion in the chemical profession. Physics became industrially important during the 1920's and 1930's and has grown very rapidly since World War II. Mathematics has always been of fundamental importance to industry but its period of very rapid growth, the seeds of which were sown during World War II, began in the late 1940's and early 1950's. Although chemistry fathered a new industry, the impact of physics and mathematics has not been predominant in any one industry but rather in a number of different manufacturing industries, notably electronics, professional and scientific instruments, and aircraft.

Generally speaking, scientific specialties which do not have large-scale industrial applications are very small fields of employment—affording opportunities chiefly in teaching for persons with advanced training. In order to offer sizable employment opportunities for persons with only 4 years of college training, a science must have developed a field of application—for example, in production or testing activities—where professional work can consist of applying established principles or already existing knowledge to the solution of practical problems, rather than in conducting research.

A longrun trend toward higher training requirements is apparent in all the natural sciences. There is a tendency to require more advanced degrees for many positions, especially in research, and there is also a growing need for more training in related sciences. The trend toward greater specialization and the blurring of the lines of demarcation between the traditional fields, mentioned earlier, have made it necessary for a scientist to know not only his own field but also those parts of other fields that are related to his work. Thus, the chemist who studies the effects of chemicals on plant and animal tissues must have a thorough knowledge of both biology and chemistry.

Future trends of employment in the sciences will be influenced primarily by two main factors—the demand for college and university teachers, and the amount of expenditure for research and product development. College and university teaching is an important source of employment for scientists with graduate training, particularly those with Ph. D.'s. The expected expansion in college enrollments during the 1960's and beyond will undoubtedly result in an increased demand for qualified scientists as teachers. (Refer to index for page number of statement on College and University Teachers.)

Expenditures for research and development are an even more important factor influencing the trend of employment in many fields of science. Funds for these purposes expended by the Federal Government, and by private industry and other sources, have grown greatly since World War II. The Federal Government, which has been the source of about half of these funds, increased its research and development spending more than 700 percent between 1941 and 1956, primarily in connection with national defense. Total expenditures for research and development in 1958 were estimated at more than $10 billion, and have undoubtedly risen substantially since then. Expenditures for research and development by industry and government are expected to continue their expansion over the long run, and so should continue to support the upward trend in employment of scientists. However, materially reduced defense expenditures would slow down or halt, temporarily, the growth of scientific employment, as would any major decline in the general level of economic activity.

The employment outlook in the major branches of the physical and earth sciences—chemistry, geology, geophysics, mathematics, meteorology, and physics—is discussed in more detail in the following statements on each of these fields.

Chemists

(D.O.T. 0–07.02 through .85)

Nature of Work

Most people think of the chemist as someone in a white coat working in a laboratory with a maze of glass tubing and intricate apparatus. This picture is reasonably accurate. The majority of chemists are employed in laboratories, primarily in research and development or in analysis and testing work. Those engaged in research and development usually work on applied research projects aimed at creating new products or improving and finding new uses for existing ones. Detergents, antibiotics and other wonder drugs, fabrics made from synthetic fibers, and

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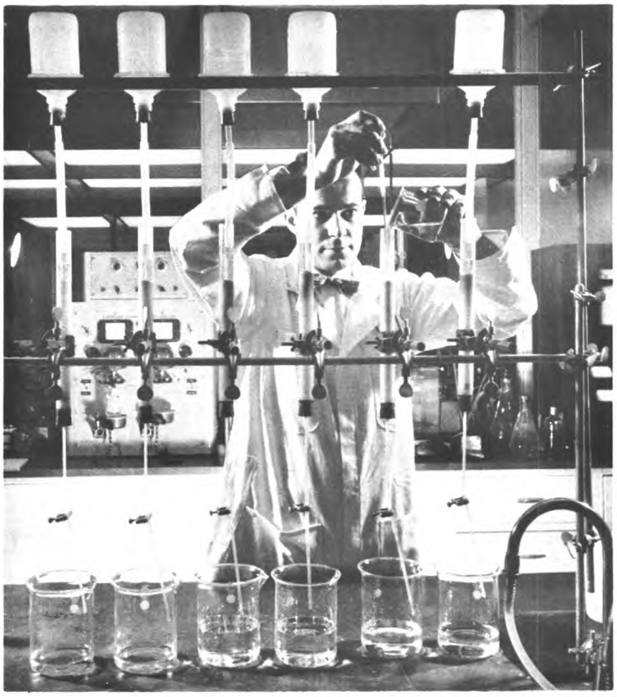


Chemists often work with complex laboratory apparatus.

rocket fuels are only a few examples of the vast range of products which research chemists have helped to create. In addition, some research chemists work on basic research projects; their interest is in extending scientific knowledge, not in solving immediate practical problems. However, many of the startling discoveries affecting our way of life have stemmed from basic research. For example, new knowledge of the chemical effects of radiation—what happens when a molecule is struck by gamma rays moving at a tremendous speed—is now being applied to the development of new methods of food sterilization which may radically affect the way in which we preserve our food.

Chemists engaged in analysis and testing, another major activity, analyze the composition of substances and test them to determine their quality, purity, and other characteristics. Tests of various kinds must be made at almost every stage in the manufacture of a product, from its initial development until it is finally sold.

Other activities in which sizable numbers of chemists are employed include administrative work and college teaching. Smaller numbers of chemists are employed by chemical and other companies to sell their products, particularly where the salesmen must be able to discuss the technical aspects of products and provide advice to the customer on how they can be used. Still other activities in which some chemists are employed include supervision of production processes, patent work, technical writing, purchasing raw materials, and marketing research. A few are self-employed as independent consultants.

Because of chemistry's vast scope, chemists usually specialize in one of the five main branches—organic, inorganic, physical, analytical chemistry, or biochemistry. They may even specialize in a subdivision of one of these branches. Organic chemists, the largest group, usually deal with carbon compounds—substances chiefly derived from animal and vegetable matter. Inorganic chemists are chiefly concerned with compounds of other elements, including most of the minerals and metals. Physical chemists study the quantitative relationships between chemical and physical properties of both organic and inorganic substances—for example, how these substances are affected by electricity, pressure, heat, and light. Biochemists are concerned chiefly with chemical reactions occurring in plants and animals, such as the effects of food or chemicals on plant and animal tissues, and with the influence of chemicals on life processes. Analytical chemists determine the exact chemical composition of substances and thereby provide controls for all types of chemical operations.

Some chemists specialize in a particular industry or product such as petroleum or plastics. In many instances, such work requires a knowledge of more than one branch of chemistry. The specialist in plastics, for example, may have to use physical as well as organic chemistry.

Regardless of their field of employment or specialization, however, all chemists are concerned in one way or another with the fundamentals of chemistry—the composition and properties of substances and how they can be changed—and also with the processes required to obtain substances from nature or produce them synthetically and the ways in which they can be put to practical use.

Where Employed

Chemistry is by far the largest field of employment in the natural sciences. There were approximately 120,000 chemists in the country in 1958, about 10 percent of whom were women.

Most chemists—almost three-fourths in 1958—are in private industry, primarily in manufacturing. The chemical industry employs the largest number (about 30,000), but manufacturers of such diverse products as food, electrical equipment, rubber, and metals, also use thousands of chemists. Sizable numbers of chemists are also employed as teachers in colleges and universities, and by Federal, State, and local government agencies. Smaller numbers are employed by research institutes and consulting services, and a few are in a variety of other fields of employment.

The greatest numbers of chemists are concentrated in the major metropolitan areas of New York, New Jersey, Pennsylvania, Illinois, California, and Ohio.

Training and Other Qualifications

A bachelor's degree with a major in chemistry is usually considered the minimum entrance requirement for beginning chemists. Graduate training is highly desirable, particularly for teaching and research jobs.

Chemists with the bachelor's or master's degree are most likely to find employment in manufacturing industries—particularly in industrial chemicals. Sizable numbers also find opportunities as research workers in government agencies. Many of those with master's degrees are employed as graduate assistants or instructors in colleges and universities while taking further graduate work.

In private industry, chemists with the bachelor's or master's degree usually begin as trainees in laboratory research or development work, in analysis, testing, quality control, technical service, production, or sales. With additional experience they may advance to positions of greater responsibility including high-level research and management positions. Many industrial employers have special training programs for chemistry graduates. These programs are designed to supplement college training with specific industry techniques and to aid in determining the type of work best suited to the individual.

The doctorate is an extremely valuable asset in obtaining most types of employment in the chemical profession. It is considered to be particularly important for obtaining jobs in basic research and is usually essential for a career in college teaching. Those receiving the Ph. D. degree are most likely to enter research and development work or teaching. In fields such as biochemistry and physical chemistry, in which teaching and research positions are predominant, the doctorate is necessary for a high proportion of the jobs.

Employment Outlook

Employment opportunities for well-trained chemistry graduates are expected to be very good during the early 1960's, and the longrun outlook is for continued expansion of employment in the profession. It is anticipated that the industries employing most chemists will grow at a rapid rate. In particular, the chemical industry, which employed about one-fourth of all chemists in 1958, is expected to expand its employment considerably faster than industry in general. In this industry and many others, continued expansion of research and development activities (in which almost half of all chemists are employed) is expected to accompany and contribute to industrial growth. Not only is further expansion anticipated in the research organizations of large companies, but more and more small and medium-size companies are instituting or expanding research programs which will require the services of chemists. Furthermore, the enormous rise in enrollments anticipated in colleges and universities will result in many openings in teaching. (See index for page number of statement on College and University Teachers.)

In addition to those needed for expansion in employment, many chemists will have to be trained each year to replace those who retire, die, or transfer to other occupations. Losses to the profession from retirements and deaths were estimated to be approximately 1,200 in 1958 and will rise slowly in the future.

Along with the expected growth in demand for chemists, a steady increase in the number of chemistry graduates is expected. Assuming that the proportion of college graduates majoring in chemistry and biochemistry remains the same as in recent years, the number of bachelor's degrees conferred in these fields in the late 1960's and early 1970's may be twice the number conferred in 1958. The numbers of master's and Ph. D.

degrees conferred each year are likely to rise correspondingly.

Even after allowance is made for the fact that many graduates with the bachelor's and master's degree in chemistry continue with graduate work, go on to studies in such related fields as medicine, or for other reasons do not seek work in the field of chemistry, it appears that a large number of new graduates at all degree levels will be available for work in the field during the 1960's. Thus, there may be increased competition for the better paying professional entry positions in chemistry. However, the rising demand for chemistry graduates with ability and thorough training will continue to provide favorable opportunities for employment and advancement for such graduates for many years to come.

Earnings and Working Conditions

Chemistry graduates with bachelor's degrees and no experience had a median starting salary of $430 per month, according to a 1958 survey conducted by the American Chemical Society. For graduates with the master's degree but no experience, the median starting salary was $511 and for those with the Ph. D. degree, $675. Women graduates had a lower median salary than men—$374 compared with $440. Some graduates, of course, earned more and others less than these median salaries. Nearly all (90 percent) of those with bachelor's degrees and no experience received more than $319 and a few (10 percent) received more than $485. Starting salaries for 90 percent of the Ph. D.'s were more than $483 per month, and 10 percent of them received more than $725. The American Chemical Society survey also showed the following median monthly starting salaries for chemists in different fields of employment:

	Bachelor's degree	*Doctor's degree*
Academic	$365	$500
Government (Federal, State, and city)	375	(1)
Research institute	358	(1)
Industrial	450	700
Biological and pharmaceutical	400	(1)
Chemical	450	700
Food	420	(1)
Petroleum	465	685
Plastics	450	700
Other	433	700

1 Not available.

In the Federal Government service, starting salaries for chemists with the bachelor's degree and no experience were either $4,490 or $5,430 a year in 1958 depending on the individual's college record. Chemists with the master's degree were eligible to start at $5,430 or $6,285, and those with the Ph. D. degree at $7,510. In addition, the salary schedule calls for periodic increases above these base salaries.

In general, chemists' salaries depend on the type of employer for whom they work, the kind of work they do, the extent and quality of their education, and the amount of their professional experience, as well as individual ability. For example, salaries of chemists employed in private industry or by Federal Government agencies are usually much higher than salaries paid by educational institutions. On the other hand, chemists in educational institutions can sometimes supplement their salaries with income from special research projects, consulting work, publications, or employment during their vacations.

Within a particular field of employment, chemists with Ph. D. degrees usually earn considerably more than those with bachelor's or master's degrees with the same amount of experience. Furthermore, earnings levels are higher in some types of work than in others. For example, chemists in administration and industrial research tend to earn more than those with comparable experience in analysis and testing.

Where To Go for More Information

Information on schools, scholarships, earnings, and other subjects may be obtained from:

American Chemical Society,
1155 16th St. NW., Washington 6, D.C.

Additional information on opportunities in the field of chemistry may also be obtained from:

Manufacturing Chemists Association, Inc.,
1825 Connecticut Ave. NW., Washington 6, D.C.

For additional sources of information, see also Chemical Engineers, Industrial Chemicals Industry, Petroleum Production and Refining and Plastics Products Manufacturing. (Refer to index for page numbers.)

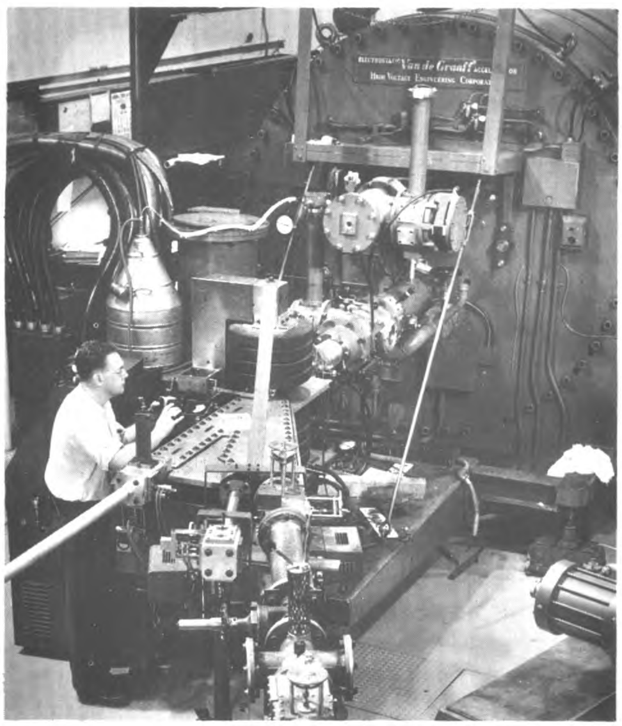
Physicists

(D.O.T. 0–35.73)

Nature of Work

Physics is concerned with energy in all its forms, with the structure of matter, and with the relationships between matter and energy. Often considered the most fundamental of all the sciences, physics was a small though growing science prior to World War II. During the past 20 years, however, physicists have made spectacular contributions in the fields of atomic energy, electronics, cosmic rays, and many other areas, and the profession has expanded greatly.

Most physicists are engaged in research or college teaching, and many do both. A sizable number conduct basic research, designed to increase scientific knowledge without regard to its practical applications. This latter group includes both "experimental" and "theoretical" physicists. Experimental physicists make careful, systematic observations and perform experiments to identify and measure the elements of matter and energy and their interactions; for example, they may try to determine the density of charged particles in the upper atmosphere or the lifetime of subatomic particles. In their research, they use apparatus such as geiger counters, spectrographs, X-ray and electron diffraction cameras, and phase and electron microscopes. When their research requires new kinds of instruments, they design and sometimes build them. Theoretical physicists, on the other hand, seek to work out theories or systems of equations which describe in mathematical terms the relationship between physical phenomena. They may use no apparatus at all but work out their theories on paper. The theories they develop sometimes help to guide experiments. However, experimental physicists frequently help to test theories. The difference between these two groups of research physicists is largely one of emphasis.



A physicist preparing a particle accelerator for an experiment.

Physicists often apply the theories and methodology of their science to problems arising out of other sciences, including geology, biology, chemistry, and astronomy. Some people have become specialists in both physics and related sciences. Thus, in recent years, a number of new scientific specialties have developed on the borderline between physics and other fields—geophysics, biophysics, physical chemistry, and astrophysics. Furthermore, the work done by physicists concerned with the practical application of the science has increasingly merged with engineering.

A large number of physicists are engaged in applied research work. They attempt to use the knowledge gained from basic research to solve practical problems and to develop new devices and products for industry or for national defense. For example, the work of physicists specializing in solid-state physics led to the development of transistors, which are being used in place of vacuum tubes in many types of electronic equipment, from hearing aids to guidance systems in aircraft and missiles.

Modern physics covers such a large area of knowledge that most physicists specialize in one or more branches of the science—mechanics, heat, light, sound, electricity and magnetism, electronics, atomic and molecular phenomena, nuclear physics, classical theoretical physics, or quantum mechanics. This list of fields is neither final nor complete, however, since modern physics is changing and expanding in too many ways to be neatly arranged in compartments. Moreover, physics specialties have a close interrelationship, and many physicists do work which cuts across a number of specialties. Every specialty of the profession utilizes principles drawn from other branches of physics, and all rest on the same fundamental principles.

Where Employed

An estimated 30,000 physicists were employed in the United States in 1958. The largest number of physicists—about half of the total—are employed by private industry. Approximately 20 percent work for colleges and universities, and between 10 and 15 percent for Federal Government agencies. The remainder are employed chiefly by research institutes, foundations and other nonprofit organizations, and by independent commercial laboratories.

There are relatively few women physicists—about 3 percent, according to data from the National Science Foundation's National Register of Scientific and Technical Personnel.

The industries employing the most physicists are electrical equipment and aircraft manufacturing. These two industries employed more than half of all physicists in industry in 1957. Other industries utilizing relatively large numbers of physicists are professional and scientific instruments, chemicals, petroleum, telecommunications and broadcasting, and machinery. Most physicists in private industry work chiefly on research and development projects.

Although teaching is, of course, the main activity of most physicists in college and university positions, many of those employed by such institutions work full time in research, often on projects conducted for the Federal Government. Part of the Atomic Energy Commission's research, for example, is done in laboratories operated by universities.

The Government agencies employing the most physicists are the Department of Defense, the National Aeronautics and Space Administration, and the National Bureau of Standards of the Department of Commerce. A few members of the profession work directly for the Atomic Energy Commission, the Department of the Interior, and the Department of Agriculture.

Training and Other Qualifications

One of the chief personal qualifications needed for a career in physics is a highly inquisitive mind. An aptitude for mathematics is also required.

A bachelor's degree with a major in physics is usually the minimum educational requirement for employment as a physicist. Graduate training, preferably a doctor's degree, is highly desirable. As much mathematics as possible should be included in the studies of anyone interested in becoming a physicist; a serious deficiency in this subject is difficult to overcome.

Doctor's degrees are required for some positions and are definitely preferred for many others. The Ph. D. degree is usually necessary for full professional status on the teaching faculty of a college or university. In research projects at such schools, the greatest demand is also for physicists with the extensive training represented by the doctor's degree. Many private companies also prefer to hire physicists with Ph. D. degrees because of the complex nature of their research problems.

Physicists with master's degrees usually qualify for applied research activities in private industry, educational institutions, and the Government, and for appointment as physics instructors in some colleges and universities. Frequently, graduate students working towards a doctor's degree are assigned to teach beginning courses in physics, conduct laboratory sessions, or aid senior faculty members on research projects.

Most physicists with bachelor's degrees find jobs with private industry or the Federal Government, usually in applied research and development work. Some physicists with the bachelor's degree become graduate research assistants in colleges and universities while working toward advanced degrees. An undergraduate major in physics is seldom sufficient, however, for full professional development as a physicist. Many persons with only a bachelor's degree in the science do not work as physicists but go into nontechnical work or, sometimes, into engineering positions.

Approximately 70 schools awarded Ph. D. degrees and about 130 gave master's degrees in 1957. Well over 550 colleges and universities had a department of physics which offered an undergraduate major in physics. In addition, many engineering schools offer a physics major as part of the general engineering curriculum. Many schools have also set up an engineering physics or industrial physics curriculum leading to a bachelor's degree, which provides training in "applied physics in an engineering atmosphere."

A few schools are offering graduate as well as undergraduate training in applied physics. Industrial firms are becoming increasingly interested in obtaining personnel with this combination of physics and engineering training.

Employment Outlook

The outlook is for continued growth in employment of physicists, both in the early 1960's and over the long run. As in recent years, there will probably be a particular demand for physicists with Ph. D. degrees who are qualified to teach advanced physics courses and do basic research or advanced applied research and development work. Modern physics is becoming so broad and complex, and is expanding so rapidly, that the advanced training represented by the Ph. D. degree is becoming more and more important. Research organizations, whether those of government, universities, or industry, have had considerable difficulty in satisfying their requirements for physicists with advanced degrees. Their needs for such physicists will probably continue to increase.

Among the major factors which have made physics one of the most rapidly growing science fields in the last decade have been the high levels of Government spending for defense and the growth of expenditures for research and development. Total expenditures for scientific research and development in the United States increased from $5.4 billion in 1953 to more than $10 billion in 1958, and have continued to grow since then. Much of this increase has been in the aircraft and parts, electrical equipment, and other science-based industries which employ large numbers of physicists.

In all probability, private industry and the Federal Government will continue to increase their expenditures for scientific research and development and thus raise the demand for physicists. If the growth in research expenditures should slacken, however, the demand for physicists would be reduced accordingly.

Demand for physicists qualified to teach in colleges and universities is expected to increase substantially in the next decade, both to take care of the much larger enrollments expected in the 1960's and to meet the growing need for advanced physics training in other science fields and in engineering. During the late 1950's, many schools were unable to recruit sufficient numbers of well qualified physics teachers, and this problem may well become more acute during the 1960's. (See index for page number of statement on College and University Teachers.)

Along with the anticipated rise in demand for physicists, an increase is expected in the number of physics graduates. In 1958, 4,445 degrees were awarded in physics—3,186 bachelor's, 795 master's, and 464 Ph. D. degrees. If the proportion of college graduates majoring in physics remains the same as in recent years, the number of physics graduates will rise—steadily during the early 1960's and at an accelerated rate thereafter. Nevertheless, it is anticipated that the demand for persons trained as physicists, particularly at the Ph. D. level, will be greater than the number of new graduates available, and very good employment opportunities for physics graduates are in prospect through the early 1960's at least, and probably for much longer.

Earnings and Working Conditions

Starting salaries for physicists with bachelor's degrees ranged from approximately $5,400 to $6,300 a year in private industry in 1958, according to the limited information available. Physicists with master's degrees received starting salaries about $600 to $1,200 higher than those of bachelor's. Annual salaries for new graduates with the Ph. D. degree ranged roughly from $7,000 to $10,000.

In Federal Government positions, in early 1959, physicists with bachelor's degrees and no experience could begin at either $4,490 or $5,430, depending on their college record. Inexperienced physicists with 1 full year of graduate study could begin at $5,430; those with 2 full years of graduate study at $6,285. Physicists with the Ph. D. degree could start at $7,510. In addition, the Federal salary schedule calls for periodic increases above these basic salaries.

Most physicists can look forward to a marked increase in earnings as they gain experience. According to the National Science Foundation's 1956–58 Register of Scientific and Technical Personnel, about 15 percent of the physicists reporting in the survey earned more than $12,000 a year, and about 2 percent earned more than $20,000.

In general, physicists in private industry tend to have higher incomes than those in other types of employment. For example, the median annual professional income of physicists was more than 15 percent greater in private industry than in Government employment, and about 30 percent greater than in colleges and universities, according to the 1956–58 Register.

Within a particular field of employment, Ph. D.'s usually earn considerably more than bachelors or masters. In private industry, according to the same 1956–58 survey, the median income of Ph. D. physicists was about 25 percent greater than that of physicists with master's degrees and about 40 percent greater than that of bachelors.

Where To Go for More Information

Additional information on the physics profession may be obtained from:

American Institute of Physics,
335 East 45th St., New York 17, N.Y.

Geologists

(D.O.T. 0–35.63)

Nature of Work

Geology is the science of the earth. Geologists study the structure and history of the earth as disclosed by rock formations on and under the earth's surface and by fossil remains of animal and vegetable life. They search for minerals and fuels and study the physical processes by which changes in the earth's structure and surface features take place.

Most geologists spend a large part of their time in field work, usually in exploring areas to determine the underground structure of the earth and the kinds of minerals or rocks that may be discovered there. Field work may involve studying rock cores and cuttings brought up by drills, examining fossils, collecting geological specimens, and recording data in notebooks or on working maps and aerial photographs. Geologists also spend considerable time in the laboratory, examining geological specimens and doing research. A large number perform administrative functions and, to an increasing extent, geologists are advancing to executive positions, especially in the petroleum and mining industries. In colleges and universities, geologists often combine teaching with research and administrative work.

Geologists usually specialize in one particular branch of the science. *Economic geologists* find and develop mineral resources. *Petroleum geologists*, who locate new deposits of oil and gas, are also economic geologists but are generally regarded as a separate category of specialists, mainly because they make up the large majority of all geologists. *Engineering geologists* apply geological knowledge to the solution of engineering problems, such as the construction of tunnels, airfields, and dams. *Ground-water geologists* study the sources, amount, and quality of water

Geologist studying core samples to determine the presence of oil or oil-bearing formations.

under the earth's surface which is available for use in agriculture, industry, and homes. *Paleontologists* are concerned with the identification and classification of the fossils of animals and plants from past geological periods. *Stratigraphers* study the arrangement and relationships of rock layers forming the earth's crust. *Petrographers* study rocks, their origin, and composition. *Mineralogists* are concerned with the physical and chemical properties of minerals and the ways of classifying them and of distinguishing them from each other. *Geomorphologists* are concerned with the form of the earth's surface and with the forces—such as erosion, glaciation, and sedimentation—which cause changes in the landscape. *Structural geologists* study the structure of rocks and the physical processes which have produced their structure.

Where Employed

There were about 14,000 to 15,000 geologists in the United States in 1958, representing approximately half of all earth scientists in the country. Most geologists—probably about 3 out of every 4—work for private industry. The great majority of these are in the petroleum and natural gas industry, which utilizes personnel in this profession chiefly in Texas, Oklahoma, Louisiana, and California, although it also employs some in nearly all other States and in foreign countries. In addition, some geologists are employed by mining and construction companies, railroads, public utilities, and manufacturing concerns—especially in the metal, stone, and clay products industries. A number of geologists are employed by consulting firms or work as independent consultants where their services are utilized mainly by private companies interested in exploration for, and extraction of, minerals and fuels.

The next largest fields of employment for geologists are the Federal Government, and colleges and universities. The large majority of geologists in Federal Government positions work for the Geological Survey of the Department of the Interior. Other Federal agencies employing geologists include the Atomic Energy Commission, the Corps of Engineers of the Department of the Army, and the Soil Conservation Service of the Department of Agriculture. State government agencies also employ a number of geologists, many of whom work on State surveys conducted in cooperation with the U.S. Geological Survey. Most government positions are located in the United States, though some Federal jobs are in the possessions and in foreign countries. Geologists in colleges and universities teach not only in departments of geology but also in mining, metallurgical, civil engineering, and other departments. A few geologists work for museums and nonprofit research institutions.

Training and Other Qualifications

Young people wishing to become geologists generally need at least a bachelor's degree with a major in geology, and graduate training is required for an ever increasing number of jobs. Some scientists, however, have entered the profession with training in petroleum and geological engineering or in related sciences.

Training in geology is offered by a sizable number of colleges, universities, and institutes of technology. In 1957, according to the U.S. Office of Education, bachelor's degrees in the science were awarded by 200 institutions, master's degrees by 80, and doctorate's, by 37.

In most colleges and universities, students majoring in geology devote about a fourth of the total semester hours during the 4 years of undergraduate study to geology courses. Usually, about a third of the work is in related natural sciences and in mathematics, and the remainder is in general studies, such as English composition, economics, and foreign languages. However, some colleges provide a more intensive program of studies leading to a bachelor's degree in geology, which allows as much as half of the undergraduate course work to be taken in the major field. In some schools of engineering that offer undergraduate programs in petroleum engineering and petroleum geology, as much as 90 percent of the work may be taken in the major field and related subjects.

For entry positions in private industry, the bachelor's degree may be adequate preparation, especially when the applicant's scientific training has been thorough and has included extensive laboratory and summer field work. However, at least 1 year of experience in the field is commonly necessary before a beginning geologist with a bachelor's degree is placed in a professional position; many of the large oil companies have formal training programs to acquaint the beginner with their operations.

Although a number of new graduates with bachelor's degrees in geology are employed by the Federal Government, persons with graduate training are preferred by some agencies. Certain Federal agencies also appoint promising undergraduates to summer jobs; upon graduation, such students may receive permanent positions with the agencies.

Postgraduate training is extremely helpful to geologists in competing for many professional positions, and may be important for advancement to the more desirable positions. The Ph. D. degree is usually essential for college teaching careers and for many research posts.

The student who plans a career in geology should have an aptitude for science and mathematics. He should like outdoor activities and have considerable physical stamina, since geological field work frequently necessitates camping out, often under primitive conditions. A willingness to travel is important, in view of the frequency with which geologists are required to move from place to place in the course of their employment.

Employment Outlook

Employment opportunities for geologists with master's and doctor's degrees are expected to be good through the early 1960's. Geologists with only the bachelor's degree, however, will probably encounter heavy competition for professional positions.

The outlook is for continued growth of the profession both in the near future and over the long run. It is anticipated that the petroleum industry will expand in this country, and that a moderate increase will occur in employment of geologists for exploration activities in the United States. It is also expected that major oil companies will further extend their search for new oilfields in foreign lands, providing increased employment opportunities abroad for American geologists. The demand for geologists in exploration for minerals and water will also increase.

As the world's petroleum, mineral, and water resources diminish, it is becoming increasingly difficult to locate new sources of supplies. Thus, additional geologists with advanced training will be needed by industry to devise new techniques for exploring deeper within the earth's crust and to search underseas areas, as well as to do more extensive research and analysis of geological data. It is also expected that Government agencies will require larger staffs of geologists. For example, the Geological Survey, which has geologically mapped only part of the total area of the United States, will need more geologists for the large amount of work of this type that remains to be done. Furthermore, the anticipated rise in college enrollments, including students interested in geology, should result in many openings for teachers of the science. (See index for page number of statement on College and University Teachers.)

Besides geologists required to fill new positions, some will be needed to replace those who retire or die. However, losses to the profession from retirements and deaths will not be numerous in the near future, since geologists are a relatively young group.

Along with the expected growth in demand for geologists, an increase in the number of geology graduates may occur. In 1958, 3,624 degrees in geology were conferred—2,788 bachelor's, 700 master's, and 136 doctor's degrees—almost as many as in the peak year 1950, when most World War II veterans graduated. If the proportion of college graduates majoring in geology remains about the same as in recent years, the number of degrees in geology would probably increase rapidly in the 1960's. Even if such an increase does not occur, many new graduates with bachelor's degrees who have only minimal training will find it difficult to enter the profession, especially in view of the increasing amount of scientific knowledge required for geological work. Such persons may be able to obtain only semiprofessional jobs in exploration activities and may find their opportunities for advancement severely limited. Nevertheless, prospects for geology graduates with ability and thorough training are expected to remain fairly good through the early 1960's.

Few women are currently employed as geologists. Their opportunities in field activities are and will continue to be limited, largely because of the rigorous nature of the work. However, some well-qualified women will be able to find positions as teachers in colleges and universities. Others trained in certain specialties, such as paleontology and petrography, will be able to obtain laboratory positions in industry and Government.

Earnings and Working Conditions

The average starting salary in early 1958 for new geology graduates with bachelor's degrees and no experience was about $440 a month in the petroleum industry, according to the American Geological Institute. New graduates with master's degrees started at about $507 a month, and those with doctor's degrees at about $641. Graduates with work experience and special skills often received above average entrance salaries.

In the Federal Government service in 1958, beginning geologists with bachelor's degrees could begin at either $4,490 or $5,430, depending on their college record; those with master's degrees at $5,430 or $6,285. New graduates with Ph. D. degrees were eligible to begin at $7,510. In addition, salary schedules call for periodic increases above these base salaries. Some geologists in supervisory and administrative positions were earning as much as $11,000 to $12,000 a year, and a few in high-level posts had even larger salaries.

Earnings of geologists are usually somewhat higher in private industry than in Government agencies. Salaries in educational institutions are usually lower than in either private industry or government, but university teachers have the advantage of long summer vacations during which they can supplement their salaries by doing research, consulting, or other work. Extra allowances are generally paid geologists for work outside the United States.

Many geologists spend a great deal of time traveling and may be away from home for extended periods of time. Their hours of work are uncertain, because their activities in the field are affected by weather conditions as well as by travel.

Where To Go for More Information

Information on the profession and the employment opportunities it offers may be obtained from:

American Geological Institute,
2101 Constitution Ave. NW., Washington 25, D.C.

The U.S. Civil Service Commission, Washington 25, D.C., will furnish general information on positions available in Federal Government agencies. For further information on such positions and how to apply for them, see chapter on Government Occupations.

Geophysicists

(D.O.T. 0–35.65)

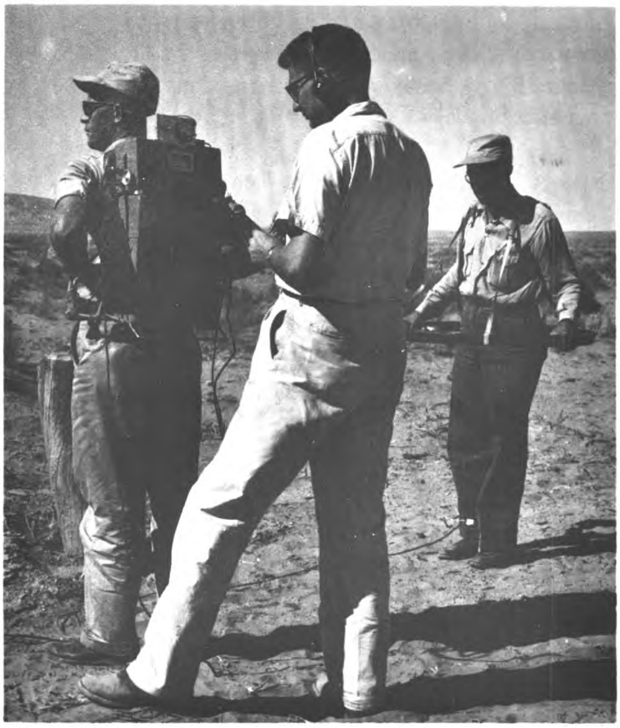
Nature of Work

Geophysics is an overall term covering a number of sciences concerned with the composition and physical aspects of the earth—its atmosphere and water-covered areas, as well as its surface and interior. Geophysicists utilize the basic principles of physics, mathematics, engineering, geology, and chemistry in investigating and measuring the earth's forces—including magnetic, electrical, gravitational, radioactive, seismic (forces responsible for earthquakes) and geothermal forces (those resulting from the earth's interior heat and from solar radiation). In studying the earth's physical characteristics, geophysicists use highly complex precision instruments such as the seismograph, which measures the transmission of vibrations through the earth's interior; the magnetometer, which measures the magnetic properties of different kinds of rocks; and the gravimeter, which measures the pull of gravity.

Exploration geophysicists are the largest group of geophysical scientists. These scientists, sometimes known as prospecting geophysicists, search for oil and mineral deposits. Most of them lead or serve as members of field parties, which may also include geologists, petroleum engineers, and other workers. Some exploration geophysicists conduct research to find new or better techniques and instruments for prospecting.

The second largest group of geophysical scientists are *hydrologists*, who study the water supply of the land areas of the earth, both at the surface and underground. Some hydrologists work on such projects as water supply for particular cities, irrigation, flood control, and soil erosion. Others specialize in the control and removal of sediment which collects in river beds and harbors. Still others are concerned with glaciers, snow surveys, and the use of permanently frozen land areas.

The other smaller groups of geophysical scientists covered by this statement are oceanographers, seismologists, geodesists, volcanologists, specialists in terrestrial magnetism and electricity, and tectonophysicists. *Oceanographers* study the ocean in all its aspects, including the sea bottom, the shores, and the interaction of the sea and the atmosphere. Those concerned with physical and geological oceanography study such matters as oceanic circulation, tides, waves, and the physical properties of sea water. Marine biologists, who study the fish and other animal and vegetable organisms which live in the sea, are sometimes classified as oceanographers although they are not geophysicists. *Seismologists* study earthquakes, both natural and man-made, and the transmission of vibrations through the earth's interior. They often provide information used in designing bridges and other buildings in earthquake regions, and often work as prospecting geophysicists in the exploration for oil and minerals. *Geodesists* measure the size and shape of the earth, determine the position and elevation of points on the earth's surface (chiefly for mapping and charting large areas), and determine variations in the direction and force of gravity over the earth's surface. *Volcanologists* are concerned with the origin, location, and activity of volcanos, hot springs, and similar phenomena. *Geomagneticians* study magnetic and electrical processes in and about the earth, including such phenomena as sunspots, the aurora, and the transmission of radio waves. *Tectonophysicists* study the structure of mountains and ocean basins, the properties of the natural materials forming the earth's crust, and the physical forces that cause movements and changes in the earth's crust.



COURTESY OF U.S. GEOLOGICAL SURVEY

A field party using electromagnetic equipment to locate uranium deposits in the Colorado Plateau.

Meteorology is another specialty which is usually classified as a geophysical science. However, this specialty is discussed in a separate statement (immediately following this one), since it represents a separate field of training and employment.

Where Employed

The number of geophysicists in the country in 1958 was estimated to be between 8,000 and 10,000. The title of geophysicist is used chiefly by persons engaged in exploration. In geophysical activities other than exploration, scientists usually have job titles which describe their specializations (for example, hydrologist, seismologist, or geodesist) or their academic training (for example, physicist or engineer).

About half of all geophysicists work for private industry—chiefly for the petroleum industry. Among the other industrial employers of geophysicists are exploration firms, consulting services, and mining companies. Geophysicists in private industry are employed mainly in the southwestern and western sections of the United States, where most of the country's large oil fields are located, although many work in foreign countries where American firms are carrying on prospecting activities.

The second largest field of employment for geophysicists is the Federal Government, which employs about two-fifths of all geophysicists. The Federal agencies employing most geophysical scientists are the Coast and Geodetic Survey, the Navy Hydrographic Office, the Geophysical Research Directorate of the Air Force's Cambridge Research Center, and the U.S. Geological Survey. In addition, a relatively small number of geophysical scientists are employed in colleges and universities, and still smaller numbers work for State Governments and for private research institutions.

Training and Other Qualifications

Degrees in geophysics are awarded by only a few colleges and universities. Many students planning to enter the relatively new field of geophysics obtain their training in geology, physics, mathematics, chemistry, or engineering, as did many present members of the profession. There is a gradual trend, however, toward the establishment of separate departments and curriculums in geophysics.

Training leading to a bachelor's degree in geophysics may be obtained in only about 14 institutions. These undergraduate programs provide training chiefly in exploration geophysics, though the curriculums may have other titles—such as geophysical technology or geophysical engineering. Some students take undergraduate training in exploration geophysics at colleges offering degree programs in engineering geology and petroleum geology. Other students prepare for exploration work by combining geology, mathematics, and physics in an undergraduate program.

To enter a geophysical specialty other than exploration geophysics, applicants often need graduate training, although it is sometimes possible to qualify through extensive undergraduate work in science and mathematics plus on-the-job training. Graduate degrees are becoming increasingly important in competing for the more desirable positions. The doctor's degree is usually essential for teaching careers and is frequently required for positions involving fundamental research.

A student interested in obtaining a master's or doctor's degree in geophysics should locate a university or institute of technology which has an extensive program in geology, mathematics, physics, and engineering, and which offers opportunities to carry out research projects in the particular geophysical science in which he is interested. For admittance into schools with graduate programs in geophysics, a bachelor's degree with a strong background in the above subjects is usually acceptable; a major in geophysics is seldom required. Institutions awarding advanced degrees in geophysics are limited in number; in 1956 and 1957, according to the Office of Education, only about 17 institutions awarded the master's degree and 14 institutions granted the doctor's degree.

New graduates with bachelor's degrees who are hired for geophysical work in industry or Government are usually given on-the-job training in the application of geophysical principles to the projects of the particular employing agency. If a new employee's college work did not include courses in geophysics, he is taught geophysical methods and techniques as part of his on-the-job training.

Some promising undergraduates have an opportunity for summer employment with Federal agencies. On these summer jobs, they receive practical training. Upon graduation from college, they may obtain permanent positions with the agencies. Similar opportunities are also provided by some exploration companies.

The prospective geophysicist needs an aptitude and interest in mathematics and the physical sciences. He should have considerable physical stamina and be willing to travel, since geophysicists often work outdoors, and explore remote areas of the earth.

Employment Outlook

The outlook is for continued growth of the profession, both in the early 1960's and over the long run. As natural resources located at or close to the surface of the earth become depleted, more exploration geophysicists will be needed to find new sites of fuel and minerals at greater depths underground and underwater, or under covering materials, such as heavy forest or sand and gravel deposits. Geophysicists with advanced training will be needed to develop new geophysical techniques and instruments. The growing recognition of the importance of basic research in the geophysical sciences will also add to the demand for geophysicists with advanced training. In addition, the findings of scientists who participated in the International Geophysical Year (1957–58)—a project sponsored by more than 60 nations, including the United States, to study many aspects of man's physical environment—are expected to create increasing and lasting interest in geophysics and geophysical research.

The oil industry will probably continue to offer a large number of employment opportunities for geophysical scientists. An increasing number of these scientists will most likely be assigned to exploration work in foreign countries, particularly in the Middle East, South America, North Africa, and Canada. In addition, mining companies are expected to employ growing numbers of geophysicists to find new mineral deposits. In Federal Government agencies, mounting civil and military demands will necessitate larger staffs of geophysicists to do such work as the mapping of land and water areas, investigation of water resources and flood control, research in radioactivity and cosmic and solar radiation, and exploration of the outer atmosphere by rockets, guided missiles, and satellites. The anticipated rise in college enrollments, including students majoring in geophysics, will result in increased openings for teachers of the geophysical sciences. (See index for page number of statement on College and University Teachers.) Furthermore, some geophysicist positions will become vacant as a result of retirements and deaths, although such openings will not be numerous in the near future, since geophysicists are a relatively young group.

Along with the anticipated growth in demand for geophysicists, a rise in the number of geophysics graduates is likely to occur. In 1957, only 92 degrees in geophysics were granted—26 bachelor's, 44 master's, and 22 doctor's degrees, according to the U.S. Office of Education. It is expected that the number of degrees in geophysical sciences will increase rapidly in the 1960's. However, the number of geophysics degrees awarded is a wholly inadequate measure of the supply of new scientists who enter the profession, since in the past, the great majority of persons entering geophysics earned their degrees in other sciences. It is anticipated that the total supply of new scientists who become available for the profession will continue to be much greater than the number who earn degrees in geophysics. Nevertheless, employment prospects for new graduates with degrees in geophysics are expected to be good through the early 1960's, at least, particularly for those with advanced degrees. Favorable employment opportunities are anticipated also for well-trained personnel who qualify through degrees in allied sciences.

Few women are employed at present as geophysicists. Their employment opportunities in field exploration are and will be limited because of the strenuous nature of the work. However, well-qualified women will be able to find positions in offices and laboratories, or as teachers in colleges and universities.

Earnings and Working Conditions

Detailed information on earnings of geophysicists is available only for Federal Government employees. In 1958, beginning geophysicists with bachelor's degrees could start in the Federal Government at either \$4,490 or \$5,430 a year, depending on their college record; those with master's degrees at \$5,430 or \$6,285. Those with Ph. D.'s were eligible to start at \$7,510 a year. In addition, the salary schedule calls for periodic increases above these base salaries. Some experienced geophysicists in supervisory and administrative positions were earning as much as \$10,000 to \$11,000 a year, and a few in high-level posts had even larger salaries.

Geophysicists working for private industry generally have somewhat higher earnings than do those employed by Government agencies. Salaries in educational institutions are usually lower than in private industry or Government, but teachers in universities have the advantage of long summer vacations in which to supplement basic salaries by doing consulting, writing, and research work. Geophysical scientists working outside the United States usually receive extra bonuses and allowances.

The duties of geophysicists, particularly in beginning jobs, often require prolonged absences from home. Work schedules are usually irregular and hours are frequently determined by travel, weather conditions, and the requirements of field activities.

Where To Go for More Information

Additional information on careers in geophysics may be obtained from:

American Geophysical Union,
1515 Massachusetts Ave. NW., Washington 5, D.C.

Society of Exploration Geophysicists,
Box 1536, Tulsa 1, Okla.

The U.S. Civil Service Commission, Washington 25, D.C., will furnish information on Federal Government positions in the geophysical sciences. For further information on such positions and how to apply for them, see chapter on Government Occupations.

Meteorologists

(D.O.T. 0–35.68)

Nature of Work

Meteorology is the science of the atmosphere. Its aim is complete understanding of the physical processes which produce the "weather." Weather forecasting is the best-known application of the science and the type of work in which most meteorologists are engaged. However, members of the profession are concerned also with many other types of problems, ranging from the study of photochemical processes in the outer atmosphere to the effect of day-to-day changes in temperature on sales by retail stores.

Weather forecasters are technically known as *synoptic meteorologists*. They interpret current weather data—air pressure, temperature, humidity, wind direction—reported by observers in local as well as worldwide networks and make short- and long-range forecasts for given localities and regions. Other meteorologists are in several smaller branches of the profession. *Climatologists*, for example, analyze records on rainfall, sunlight, temperature, wind and other weather data, and utilize this information for many purposes, including improvement of forecasting, and the planning of military and business operations. *Dynamic meteorologists* study the physical laws of air movement. *Physical meteorologists* study the atmosphere's chemical composition and electrical properties; solar radiation; the transmission through the atmosphere of light, sound, and radio waves; and all the factors affecting clouds and rainfall. Scientists specializing in applied meteorology (sometimes called industrial meteorology) are concerned with the relationship between weather and specific human activities, biological processes, and industrial operations. For example, they make special forecasts for individual companies, conduct climatological studies for large commercial farming enterprises, attempt to induce rain or snow in a given area through cloud seeding, and work on such problems as smoke control or air pollution.

Growing numbers of meteorologists in both Government and private employment are engaged in research, ranging from practical industrial problems to basic theory. The increasing use of the atmosphere as a medium of transportation and communication has focused attention on the meteorological aspects of rockets, guided missiles, earth satellites, radio propagation, and cosmic rays. In addition, research is being conducted on such subjects as long-range forecasting, radioactive "fallout," severe weather phenomena, weather control, aircraft icing, and solar heating.

Meteorologists who teach in universities or colleges may also do research or act as consultants.

COURTESY OF U.S. WEATHER BUREAU

Meteorologist analyzing weather chart in the preparation of weather forecast.

In colleges without separate departments of meteorology, they may teach subjects such as geography, mathematics, physics, and geology as well as meteorology.

Where Employed

More than 6,000 meteorologists were employed in the United States in 1958. Of these, approximately 2,600 were on active duty in the Air Force, and some were in the Army and Navy. In addition, the Air Force employed approximately 175 civilian meteorologists, and the Army and Navy together employed about 100. Meteorologists on active duty are usually engaged in weather forecasting for military operations; whereas, most civilian meteorologists in the Armed Forces conduct research.

Approximately 2,300 meteorologists were working for the United States Weather Bureau, at about 300 stations located in all parts of the United States, the polar regions, Puerto Rico, Guam, and other sites in the Pacific area. Other Government agencies, such as the Forest Service of the Department of Agriculture and the National Aeronautics and Space Administration, also employed a few meteorologists.

Aside from Government, the main fields of employment for meteorologists are airlines, educational institutions, and weather consulting services. Approximately 275 meteorologists were working for commercial airlines in 1958—forecasting the weather along their companies' flight routes and briefing pilots on the weather conditions they might encounter. Colleges and universities with departments of meteorology employed 150 meteorologists, and other colleges without separate departments probably employed about an equal number. In 1958, private weather services employed about 150 meteorologists to deal with their clients' special weather problems. In addition, companies that design and manufacture meteorological instruments and balloons employ meteorologists on a full-time basis, as do a number of large companies in the aircraft, insurance, utilities, and other industries. Other meteorologists present weather programs for radio and television stations. A few are employed as editors and librarians.

There are relatively few women meteorologists. Most of them are employed by colleges and universities, primarily in research rather than in teaching positions. A very small number work as forecasters for the Weather Bureau. Some women are on active military duty as meteorologists in the Air Force.

Training and Other Qualifications

Young persons wishing to become meteorologists usually need a bachelor of science degree with a major in meteorology or in a related science field. Their training should include physics and mathematics as well as meteorology. New graduates with only the bachelor's degree qualify mainly for employment in weather forecasting. Advanced training, including not only graduate work in meteorology, physics, and mathematics, but also courses in chemistry, is desirable for work in the other, more specialized branches of the profession, and for teaching and research.

Degree in meteorology are offered by relatively few colleges and universities. In 1957, bachelor's and graduate degrees in the subject were awarded by only 15 institutions. However, many other institutions offer courses in meteorology which, if combined with sufficient training in physics and mathematics, may serve as adequate preparation for most professional entry positions. For example, for beginning positions with the Weather Bureau, the minimum requirement is a bachelor's degree with at least 20 hours' training in meteorology in addition to selected courses in mathematics and physics.

Meteorological training is also offered by the Armed Forces. Each year, the U.S. Air Force selects over 100 college graduates who have received a commission through the Air Force Reserve Officers Training Corps (AFROTC) and sends them to selected civilian universities for 1 year so that they may qualify as meteorologists. Graduates of this program are then assigned to meteorological work. Other branches of the Armed Forces also have programs for training meteorologists. Ex-servicemen with training and experience of this type are given preference for civilian positions with the Armed Forces and can also qualify for positions with other employers of weather personnel.

The Weather Bureau has an in-service training program for its employees. Each year, scholarships are granted to Weather Bureau meteorologists to enable them to take more advanced and specialized training. A student-trainee program is also conducted by the Weather Bureau. Eligible high school graduates and college students preparing for a career in meteorology may obtain summer jobs with the agency until they receive degrees. They may then be employed as meteorologists.

Promotions in the Weather Bureau, as in other Federal Government agencies, are given according to Civil Service regulations. (See chapter on Government Occupations.) With the airlines, the chances for advancement are limited. However, some meteorologists in the largest companies may attain positions as supervisory meteorologists. Airline meteorologists are also able to qualify as dispatchers, after considerable work experience. Some well-trained meteorologists, with a background in science, engineering, and business administration, may find their best opportunities for advancement in the profession through the establishment of their own weather consulting services.

Among the personal characteristics needed by meteorologists are mathematical aptitude and an interest in physical science. Since most of the work is performed in an office, unusual physical stamina is not generally required. For some jobs, the ability to draw quickly and neatly is important.

Employment Outlook

The outlook is for continued growth of the meteorological profession both in the early 1960's and over the long run. The demand for meteorologists should grow primarily as a result of continued expansion of meteorological research programs and increased awareness, in both the Federal Government and private industry, of the value of accurate weather information. In addition, America's entry into the "space age"—the age of supersonic aircraft, rockets, and space travel—is expected to broaden considerably the horizons of meteorology, thereby creating new applications of the science.

Employment of meteorologists in the Weather Bureau, by far the largest civilian employer of these scientists, is expected to increase during the next decade. In recent years, many new positions have been provided by the expansion of weather forecasting services, and by new or expanding programs of hurricane research, air pollution research, storm warning, and flood forecasting, which were authorized by Congress in 1955. The Bureau looks forward to continued growth of its research programs—into such fields as atmospheric radiation, weather modification, and upper air movements. Further increase in the Bureau's forecasting staff is also anticipated, since the continued expansion in civilian aviation will probably result in the building of new airports and weather stations. In early 1958, the Bureau estimated that it would need between 75 and 100 meteorologists yearly during the early 1960's to fill new positions in research and forecasting and to replace workers who retire, die, or transfer to other employers. However, the exact size of the Bureau's staff, like that of all other Federal agencies, depends on the appropriations voted by Congress each year.

Employment opportunities for meteorologists in weather consulting services and on the staffs of private companies are also expected to increase somewhat. More and more businessmen are utilizing weather and climatic data in planning their operations, and are turning to industrial meteorologists for assistance in solving their weather problems. As the value of this type of service receives further recognition, the demand for industrial meteorologists will continue to grow.

Opportunities for meteorologists with the airlines will be limited during the 1960's. However, increased research work on problems relating to the high speed, high altitude jet aircraft will require a few exceptionally qualified meteorologists with advanced scientific knowledge. In other airline positions connected with flight operations, occasional opportunities are expected as workers retire, die, or transfer to other positions. Although air traffic will no doubt continue to increase rapidly, the airline meteorologists who forecast weather conditions in given areas will generally be able to service the additional flights.

In colleges and universities, opportunities for meteorologists are expected to rise over the next decade, with the anticipated increase in college enrollment. The Armed Forces will also have some openings for civilian meteorologists.

Although the outlook is for continued growth

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of the profession over the long run, meteorology is a small profession and the number of job openings arising in any 1 year will not be large. On the other hand, the number of new graduates with degrees in meteorology has always been small. In 1957, only 79 bachelor's degrees in meteorology were granted—slightly more than half the all-time record number (143) awarded in 1950, when many veterans graduated. Furthermore, graduates with majors in other fields, such as physics and mathematics, and some training in meteorology have been difficult to attract into weather forecasting or research, because of the many opportunities open to them in other fields. Officers who worked as meteorologists upon leaving the armed services have also gone, in most instances, into other fields of work, instead of seeking civilian positions in meteorology. Thus, assuming that these conditions remain the same, as appears likely, new meteorology graduates should have favorable employment opportunities through the early 1960's, at least.

Earnings and Working Conditions

In Federal Government agencies in 1958, beginning meteorologists with the bachelor's degree could begin at either $4,490 or $5,430 a year, depending on their college record. Inexperienced meteorologists with 1 full year of graduate study could start at $5,430; those with 2 full years, at $6,135. Beginning meteorologists with doctor's degrees were eligible to begin at $7,270. In addition, the salary schedule calls for periodic increases above these base salaries. Some meteorologists in supervisory and administrative positions were earning as much as $10,000 to $12,000 a year, and a few in top-level posts received still higher salaries. Workers stationed outside the United States are paid an additional cost-of-living allowance or post differential. The provisions for salary increase, paid vacations, sick leave, pensions, life insurance, and other benefits are the same for meteorologists as for all other Federal Civil Service employees. (See chapter on Government Occupations.)

Recent earnings data for meteorologists in private industry are available only for the airlines. In late 1958, meteorologists with the airlines had a starting monthly salary of about $415 and a top salary of $715—reached after 9 automatic yearly increases. A few meteorologists in top supervisory positions with airlines earned between $10,000 and $12,000 a year in 1958.

Jobs in weather stations—which are operated on a 24-hour, 7-day week basis—often involve nightwork and rotating shifts. Most stations are located at airports or other places in or near cities. However, some are in isolated and remote areas.

Where To Go for More Information

General information on the profession may be obtained from:

American Meteorological Society,
3 Joy St., Boston 8, Mass.

The U.S. Weather Bureau, Washington 25, D.C., will answer inquiries on employment opportunities with that agency, and will provide information on its student-trainee program.

Mathematicians

(D.O.T. 0–35.76)

Nature of Work

Mathematics is one of the oldest and most basic fields of science. It is also one of the most dynamic and rapidly growing professions. Mathematicians are currently engaged in a wide range of activities, including research on the behavior of the atom, calculating orbits of earth satellites, and translating business and scientific problems into mathematical terms for solution by electronic computers.

There are three broad classes of mathematical work—pure or theoretical mathematics, applied mathematics, and mathematical computation. Theoretical mathematicians are concerned with the logical development of mathematical systems and the study of the relations among various mathematical forms. In a sense, pure mathematics is an art and pure mathematicians are simply attempting to perfect the art. They seek to increase basic mathematical knowledge without necessarily considering the use to which this knowledge may be put. However, many scientific and engineering achievements have resulted from the application of this pure and abstract mathematical knowledge. For example, an abstract and seemingly impractical non-Euclidean geometry invented in 1854 by Bernhard Riemann was to be the foundation for Albert Einstein's theory of relativity more than a half century later.

Mathematicians engaged in applied work develop mathematical techniques and approaches to be used in solving problems in engineering, physics, economics, and many other fields. They analyze each problem, and attempt to describe it in terms of a mathematical system. Mathematicians doing this kind of work need not only competence and imagination in mathematics, but also knowledge of the field in which they are working. Pure and applied mathematics are not always sharply separated in practice. Many important developments in theoretical mathematics have arisen directly from practical problems. For example, the differential calculus was developed by Isaac Newton to deal with physical problems involving the velocity and acceleration of moving objects—phenomena which could not be described satisfactorily by earlier systems of mathematics.

The third broad type of mathematical work consists of utilizing mathematical knowledge and modern equipment, ranging from desk calculators to complex electronic computers, to obtain numerical answers to specific problems. Although such work often requires a very high level of mathematical knowledge and skill, many openings in this field—such as for programmers and coders for digital computers—do not require the advanced training and inventiveness needed by the first two types of mathematicians. Much of the mathematical work done in the field of scientific research and development, as well as in statistics and business, is of this type. (Actuaries and Statisticians are discussed in separate statements. See index for page numbers.)

Where Employed

The total number of mathematicians in 1958 was about 28,000, of whom more than 3,000 held Ph. D. degrees. Relatively few mathematicians are women—about 9 percent, according to data from the National Science Foundation's National Register of Scientific and Technical Personnel.

The largest number of mathematicians—about one-half of the total in 1958—are employed by industry. Colleges and universities also employ a sizable number—about one-fourth of the total in 1958. Most of the remainder are employed by government agencies, chiefly the U.S. Department of Defense and the U.S. Department of Commerce; by foundations and other nonprofit organizations; and by commercial laboratories.

Principal industrial employers of mathematicians are the electrical equipment and the aircraft industries. The machinery and petroleum industries also utilize significant numbers of mathematicians. These four industries accounted for more than half of all mathematicians employed in industry in 1958.

Training and Other Qualifications

A bachelor's degree with a major in mathematics is normally the minimum entrance requirement for persons seeking careers as mathematicians. However, a degree in another subject, with a strong minor in mathematics, may be adequate for some beginning positions involving relatively routine work.

Graduate training is required for many mathematical positions, particularly in research and teaching. In industry, advanced degrees are required for an ever-increasing number of jobs, not only in research but also in many areas of applied mathematics. The Ph. D. degree is especially important for most college and university teaching positions and for the more advanced research work.

For teaching and research in applied mathematics, training in the field to which mathematics is to be applied is important. For many applied mathematicians, the fields of application are physics and engineering. Other fields of application are business and industrial management, economics, statistics, chemistry, and biology. For teaching and research in pure mathematics, however, training in a specific field of application is not generally necessary.

The development in recent years of high-speed electronic computers has brought a growing need for mathematicians particularly qualified to work with these machines. Knowledge of numerical analysis is especially important for this work. Setting up the detailed instructions or program used to guide the computer also calls for special training. (For further information, see statement on Programmers. Refer to index for page number.)

Among the personal qualifications needed by mathematicians are a keen logical mind, imagination, intellectual curiosity, and a desire to analyze and solve new and difficult problems. Mathematicians must also be able to express themselves simply and comprehensibly in order to present mathematical ideas to scientists, engineers and others who use mathematics but are not mathematicians.

Employment Outlook

The outlook is for continued rapid growth of employment in mathematics, both in the early 1960's and over the long run. As in recent years, there will be particular need for mathematicians with Ph. D. degrees for research, teaching, and some applied mathematics positions.

One of the major factors which will tend to increase employment of mathematicians is the growing demand for their services in scientific research and development. This demand is closely associated with the development of high-speed electronic computing machines which make possible the rapid solution of a steadily widening variety of complex physics and engineering problems in such fields as operations analysis, logistics, inventory control and scientific management. The demand is chiefly for applied mathematicians to evaluate these problems and prepare them for solution by electronic computers.

In all probability, private industry and the Federal Government will continue to increase their expenditures for physics and engineering research and development, and thus raise the demand for mathematicians. If the growth in research expenditures should slacken, however, or increase more rapidly than now anticipated, the demand for mathematicians would change accordingly.

High-speed electronic computers have also opened up whole new fields of application for mathematics in business management. Large computers not only provide accounting and other data very rapidly, but also make possible analyses of business operations—sometimes called operations research—which often were not practicable with less advanced equipment.

The demand generated by these computers—in scientific research and development, in business management, as well as in other areas—is a demand for employees who can apply mathematics to specific problems, not simply for mathematicians as such. Undoubtedly, a part of this demand will be satisfied by including more advanced mathematical training in the education of engineers, biologists, and specialists in other fields to which mathematics is applied. Nevertheless, there will be a growing demand for applied mathematicians who combine a high degree of mathematical competence with a broad knowledge of the field of application. There will also be an expanding demand for people to do mathematical computation work.

Employment of mathematicians as teachers in colleges and universities is also expected to increase substantially, both to take care of the much larger enrollments expected in the 1960's and to meet the growing need for more advanced mathematical training in many fields of study. The increased demand for college mathematics teachers will largely be a demand for mathematicians with Ph. D. degrees, but there will continue to be many positions for holders of master's degrees. Colleges and universities will also continue to provide most of the employment opportunities for specialists in theoretical mathematics.

Along with the anticipated rise in the demand for mathematicians, an increase is expected in the number of mathematics graduates. In 1958, 8,142 degrees were awarded in mathematics—6,835 bachelor's, 1,097 master's, and 210 doctor's. If the proportion of college graduates majoring in mathematics remains the same as in recent years, the number of degrees awarded in mathematics will rise rapidly during the next decade. By the late 1960's or early 1970's, the number may be double the number conferred in 1958. Nevertheless, employment opportunities for mathematicians are expected to remain very good through the early 1960's, at least, and probably longer.

Earnings and Working Conditions

Starting salaries for mathematicians with bachelor's degrees ranged from about $5,400 to $6,300 a year in private industry in 1958, according to the limited information available. Mathematicians with master's degrees received starting salaries of about $600 to $1,200 per year higher than those with bachelor's degrees. Annual salaries for new graduates with Ph. D. degrees ranged from approximately $7,000 to $10,000.

In Federal Government positions in 1958, mathematicians with bachelor's degrees and no experience could begin at either $4,490 or $5,430 a year, depending on their college record. Inexperienced mathematicians with one full year of graduate study could begin at $5,430; those with two full years of graduate study at $6,285. Beginning mathematicians with Ph. D. degrees could start at $7,510. In addition, the Federal salary schedule calls for periodic increases above these basic salaries.

Most mathematicians can look forward to a marked increase in earnings as they gain experience. According to the National Science Foundation's 1956–58 National Register of Scientific and Technical Personnel, 15 percent of the mathematicians reporting in the survey earned more than $12,000 a year, and about 3 percent earned more than $20,000.

In general, mathematicians in private industry tend to have higher incomes than those in other types of employment. For example, the median annual professional income of mathematicians was about 15 percent greater in private industry than in Government employment, and about 47 percent greater than in colleges and universities, according to the 1956–58 Register.

Within a particular field of employment, holders of Ph. D. degrees usually earn considerably more than those with bachelor's or master's degrees. In private industry, according to the same 1956–58 survey, the median income of Ph. D. mathematicians was 23 percent greater than that of mathematicians with master's degrees and nearly 30 percent greater than the median income of mathematicians with bachelor's degrees.

Where To Go for More Information

American Mathematical Society,
190 Hope St., Providence 6, R.I.

Mathematical Association of America,
University of Buffalo, Buffalo 14, N.Y.

BIOLOGICAL SCIENCES

The biological sciences are concerned with the world of living things—men and microbes, wild and domestic animals, plants and insects, birds and fish. This chapter covers botany, microbiology, and zoology, in addition to other biological sciences in which activities are centered on the search for knowledge about the fundamental laws of biology and the collection of basic information about plants and animals. Most scientists in these fields are employed in college teaching or in basic research aimed at adding to our knowledge about living organisms regardless of whether such knowledge is of immediate practical use. For example, the biologists who developed a method for growing polio virus in living tissue, an essential step in the evolution of the Salk polio vaccine, knew that their work might eventually have some practical value but their immediate purpose was to learn more about the way viruses act on living cells. Physicians, foresters, and many others in health service and agricultural occupations who use biological knowledge primarily to solve practical problems are not usually considered biological scientists and their work is discussed elsewhere in the Handbook. (For statements on health service occupations, foresters, and specialized agricultural occupations, see index.)

Biologist studying the effect of radioactivity on living tissue.

Nature of Work

Biological scientists study the structure of living organisms, their life processes, and the relation between living organisms and their environment. The number and variety of plants and animals are so immense and the life processes so varied and complex that biologists must, of necessity, become specialists. Some biologists spend a lifetime trying to learn as much as possible about a particular kind of animal or plant. Others are interested in how the body functions and study such things as the circulatory system, how food is digested, or the ways in which organisms are affected by disease. Some are interested in the evolution of living organisms, in the mechanism of heredity and in the ways in which environmental factors, such as major changes in climate or radiation, have affected the development of different species or might do so in the future.

The majority of biological scientists are engaged chiefly in research. This research is of many kinds. It may be conducted inside a laboratory or outdoors, at the far corners of the world or near a quiet university town. A botanist exploring the volcanic Alaskan valleys to see what plants live in this strange environment and a zoologist searching the jungles of the Amazon valley for unknown specimens of animals and fish are both doing field research. The agronomist does experimental research with crop plants, growing seeds under controlled conditions to see how various strains compare in their resistance to pests, changes in climate or soil, or other factors. Some of them work at State agricultural experiment stations. Many entomologists do field research in the open at one of the many field stations maintained by the U.S. Department of Agriculture in this country and abroad. They investigate the quantity and distribution of insects, the causes which promote their growth, and the methods of controlling them. Others work in laboratories, sometimes as part of a team of specialists in several biological sciences testing the effectiveness of various chemical insecticides and their possible hazards to human and animal life.

Some of the most exciting research in biology is being done in microbiology (including bacteriology), physiology, genetics, biophysics, and pharmacology. These specialties are often grouped with biochemistry as in the field of experimental biology. (For additional information on Biochemistry, see index.) The microbiologist works in a laboratory where light, temperature, humidity, and other environmental factors can be controlled in conducting experiments. He works largely with test tubes, cultures, microscopes, and a variety of other specialized laboratory equipment. The microbiologist who cultures viruses within tissues living in test tubes so that he can observe virus action more closely and discover how they multiply, is doing work which will give us a better understanding of the borderline between life and nonlife. This work may eventually lead to the discovery of new vaccines to control some of our most stubborn infectious diseases, such as tuberculosis, rheumatic fever, and influenza. The soil bacteriologist analyzes samples of different soils to find bacteria, molds, algae, protozoa, and other micro-organisms and observe their relationship to soil fertility; to plant diseases; and to the growth, processing, and storage of crops. The physiologist may use the methods of chemistry and biophysics to find out how cells utilize the energy of food for such processes as muscular coordination, how hardening of the arteries develops, or how muscles respond to impulses of the nervous system. The biophysicist uses the electron microscope to visualize tissues down to their smallest units, the molecules; he may use nuclear reactors, X-ray machines, microscopes, and photomicrographic apparatus to study the effect of high energy radiations on cell division in, say, immature insects. The geneticist in his search for more information about the mechanisms of heredity conducts experiments with fruit flies, guinea pigs, or other animals or plants that reproduce rapidly. Pharmacologists conduct experiments with rats, guinea pigs, monkeys, and other animals to discover the effects of drugs, gases, dusts, poisons, and chemicals on the tissues of living creatures.

In all of these different types of research, the biologist must have at his command the fundamental techniques of biological and chemical research, such as skill in the use of microscopes and other laboratory equipment in making and staining sections, and in classifying and identifying specimens. In the experimental field, advanced techniques and tools taken from the field of chemistry or physics are frequently used and, to an increasing degree, a knowledge of mathematical and statistical procedures is needed to organize and analyze the data gathered, owing to the enormous number of variable factors involved.

Teaching in colleges and universities is the major function of about one-third of the biological scientists. However, most college teachers of biological sciences combine independent research with their regular teaching duties and in some large institutions spend the major portion of their time on research. The college teacher is likely to have some classes to which he lectures several times a week, and possibly a group of graduate students who may attend seminars and conduct research projects under the teacher's guidance as part of their training. College professors frequently help their graduate students find jobs, counsel incoming students, attend university committee meetings, and handle a variety of other administrative duties in connection with their teaching work.

More than 1 in 10 biological scientists do management and administrative work. This may involve supervising and administering industrial, nonprofit, or governmental laboratories engaged in research or in testing foods, drugs, insecticides, and other products. Biological specialists act as liaison between the Federal Government and the experiment stations at the State universities, and aid in the planning, development, and evaluation of research programs at these stations. The so-called "action" programs which bring the findings of biological or agricultural research workers to the attention of farmers, industrialists, and public health officials who use these findings require some highly trained specialists. However, extension workers, who themselves need only a very general background in the biological or agricultural sciences, conduct most of the work in the action programs.

Relatively small numbers of biologists are engaged in a variety of other types of work, such as consulting, writing, routine testing, and technical sales or field service work for industrial firms. Such work includes teaching company salesmen and prospective purchasers the value and proper use of new chemicals when used as food preservatives or insecticides or for other purposes. Biologists in this group, other than consultants and writers, are sometimes described as "biological technicians."

All biological scientists can be grouped into three broad and general subdivisions, characterized on the basis of the variety of organism with which they work: Botanists (plant scientists), microbiologists, who work with microorganisms, and zoologists (animal scientists). Those whose work cuts across several of these major subdivisions, as is frequently the case with college teachers, may simply call themselves biologists. Within each of the three major subdivisions are many subspecialties, which may relate to the specific type of organism studied, as in the cases of mycologists (botanists who study fungi); or may indicate the sort of approach used in studying organisms, as in the case of geneticists, who may be botanists, zoologists, or microbiologists studying the mechanisms of the heredity of sweet peas, fruit flies, or viruses. Some of the biological scientists work in what may be considered the broad subdivisions of the field and others work in what might be considered subspecialties. A description of the work of some biological scientists follows:

Botanists (D.O.T. 0–35.23) are concerned with the study of the fundamental principles governing the life processes of plants. Botanists include specialists in identifying and classifying plants, such as plant taxonomists (scientists primarily concerned with the structure of plants and plant cells); plant morphologists (those whose primary interest is in the life processes of plants and the ways in which they grow, develop, and reproduce); and plant physiologists (specialists in other phases of plant life).

Microbiologists (D.O.T. 0–35.33) specialize in the study of bacteria, viruses, molds, and other organisms of microscopic or submicroscopic size. The terms microbiology and bacteriology are sometimes used interchangeably, but microbiology is the broader term and is preferable when referring to the study of all microscopic organisms. It includes the study of medical problems through experiments with cells or other microscopic components of the body. Some microbiologists specialize in soil bacteriology (the study of bacteria, molds, algae, and protozoa and other microorganisms in soils, and the relation of such organisms to soil fertility, and other agricultural problems). Others specialize in virology (the study of viruses which cause diseases in animals or plants), immunology (the study of mechanisms by which the body fights off infection), or serology (the study of animal fluids including blood serums). Others specialize in the study of molds in the processing of food products, or in the search for new or better antibiotics. Many specialize in the testing and production of biological products or in testing water supplies, milk, or other foods in the control and prevention of contagious diseases. Microbiology is an expanding field with a growing number of specialties and the listing above is merely illustrative.

Zoologists (D.O.T. 0–35.28) study all phases of animal life—the origin, classification, life history, behavior, life processes, animal parasites, and diseases caused by them, and the ways in which animals influence and are influenced by their environment. Some zoologists make field trips to study animals in their natural environment and to collect specimens. Others work mainly in laboratories, dissecting and studying dead animals or conducting experimental studies with live ones. Zoologists who specialize in the study of certain classes of animals usually identify themselves with their specialties, which include, for example, ornithology (the study of birds), herpetology (the study of snakes), ichthyology (the study of fish), and mammalogy (the study of mammals). Teachers and others whose work cuts across several of the animal science fields generally use the title of zoologist.

Agronomists (D.O.T. 0–35.01) do research pertaining to growing, breeding, and improvement of plants which are generally grown in large acreages such as corn, wheat, tobacco, cotton, and sugar. They develop new varieties of crops more resistant to the hazards of weather, disease, and insects and search for better methods of growing crops and controlling weeds and pests. Agronomists may specialize in problems of a specific geographical area, a particular crop, or a technical specialty such as crop breeding or production methods.

Anatomists (D.O.T. 0–35.36) study the form and structure of organisms and the structure and organization of their specialized organs. They may study structures visible to the naked eye, those of microscopic size, or those of submicroscopic size visible only through the use of the electron microscope. Many anatomists specialize in human anatomy. Others are comparative anatomists who study animal and plant species.

Biophysicists (D.O.T. 0–35.49) are trained in both physics and biology and study the physical properties and relationships of living cells and organisms—including mechanics, heat, light, radiation, sound, electricity, and energetics. Radiobiology is a rapidly growing field of biophysics. It includes many aspects ranging from the study and use of radiation and nuclear particles in the treatment of cancer to observing physical factors involved in the entrance of chemical substances into cells.

Embryologists study the development of an organism from the time of fertilization of a single cell until it becomes a complete organism, animal or plant. They study the physiological and biochemical mechanisms which control and direct the developmental processes and the ways in which this control is accomplished.

Entomologists (D.O.T. 0–35.30) are concerned with the study of insects—how they function and the ways in which they affect human beings, animals, and plants. Some entomologists specialize in identifying and classifying insects—an enormously difficult undertaking, since there are more than 75,000 species of insects in the United States and Canada alone. This is an important field because proper identification of insects is basic to their control and thus to preserving food supplies and controlling disease. Many entomologists do research on methods of insect control through the use of chemicals, predatory birds, other insects, biological methods such as insect diseases, or mechanical means. Others study ways of utilizing beneficial insects such as honeybees, which not only produce valuable quantities of honey and wax but are also essential in pollinating crops so that they will mature and yield good harvests.

Geneticists (D.O.T. 0–35.35) specialize in the study of factors of heredity—the way in which various biological characteristics are transmitted from one generation to another. Geneticists interested primarily in the improvement of plant and animal breeds of economic importance—such as cereal or tobacco crops, dairy cattle, or poultry —may be classified as plant or animal breeders or agronomists or animal science specialists. Theoretical geneticists search for the fundamental laws of heredity and the mechanisms which produce heritable traits in plants or animals. They conduct experiments with fruit flies, guinea pigs, or other animals or plants that reproduce with sufficient rapidity to meet experimental requirements.

Horticulturists (D.O.T. 0–35.05) deal with orchard and garden plants such as fruits, nuts, vegetables, flowers and ornamental plants, and nursery stock. They develop new plant varieties and improved methods of growing, harvesting, and storing horticultural crops. Horticulturists usually specialize in some specific vegetable, flower, or fruit or in technical problems such as plant breeding or cultural practices.

Husbandry specialists (*animal*) (D.O.T. 0–35. 13, .14, and .15) carry out investigations and experiments on breeding, feeding, and management of cattle, hogs, sheep, poultry, and other domestic animals, and in animal and poultry diseases. They may specialize in problems of feeding and nutrition, of breeding and genetics, or of animal physiology.

Nutritionists study the processes through which human beings and animals utilize food; the kinds and quantities of food elements, such as minerals, vitamins, fats, sugars, and proteins, which are essential to maintain the best state of health; how these food elements are transformed into bodily substances; and what role they play in bodily processes and functions. Nutritionists also analyze foods to determine their composition in terms of the food elements essential to nutrition.

Pathologists study the causes and processes of disease, degeneration, and abnormal functioning in human or animal organisms. They may specialize in the study of the effects of diseases, parasites, and insect pests on organs and tissues; in histology, which is the microscopic study of animal and plant tissues; or in the structure or anatomy of diseased organs. They also study the chemistry and physiology of tissues to see whether they are abnormal and if so, in what way. The term "pathologist" is normally reserved for students of human pathology (medical pathology); specialists in animal pathology are usually veterinarians. Those who study plant diseases may be called plant pathologists or phytopathologists. Their work is discussed under the heading "phytopathologists."

Pharmacologists (D.O.T. 0–35.34) are concerned primarily with the study of how drugs, useful in the prevention or treatment of disease or in other phases of medicine, affect life processes, and with the discovery and development of new chemical compounds which will have certain desired effects on organisms. They conduct experiments with rats, guinea pigs, monkeys, and other animals to determine the physiological effects of drugs, gases, dusts, poisons, and chemicals on the tissues and organs of living creatures, and correlate their studies with clinical medical data on the effects of such substances on human beings.

Physiologists (D.O.T. 0–35.13) study the functioning of organisms during life and how life processes operate. They may specialize in the study of the heart, circulatory system, glands, nerves, cellular activities, or digestive, excretory, reproductive, or other systems. They conduct experiments to determine the effects of environmental factors on life processes. The knowledge gained in such studies provides the basis for the work of many other specialists, such as pathologists, pharmacologists, or nutritionists.

Phytopathologists (D.O.T. 0–35.26) or plant pathologists specialize in the causes and control of plant diseases produced by parasitic organisms, viruses, chemicals, and other agents. Some specialize in the pathology of a specific plant or group of plants, such as forest trees, vegetable crops, ornamental plants, and field crops. Others work only with certain organisms or groups of organisms affecting plants, such as fungi, viruses, or bacteria.

Where Employed

About 50,000 scientists were employed in the basic biological sciences in 1958. Perhaps 10 percent were women, and about one-third of the women scientists specialized in microbiology and bacteriology.

More than half the biological scientists were employed in colleges and universities, according to a National Science Foundation 1954–55 survey of biological scientists with a graduate degree or a minimum of 4 years of experience in addition to a bachelor's degree. Approximately 25 percent were employed by government organizations —Federal, State, local, and international; about 10 percent by private industry; and a small number, perhaps 2 percent, were self-employed. About 5 percent were in nonprofit organizations, mainly hospitals, clinics, and privately financed research organizations or foundations. The remainder were employed in educational institutions other than colleges and universities.

The biologist's specialty largely determines the type of organization he will work for. More than two-thirds of those specializing in anatomy, physiology, zoology, botany, and genetics and a majority of biologists in most other specialties are employed in colleges and universities. Government agencies—Federal, State, and local—are the principal employers of agronomists, entomologists, and fish and wildlife biologists. Biological scientists specializing in agronomy, horticulture, animal husbandry, entomology, or other subjects related to agriculture are employed chiefly in State agricultural colleges and universities and in agricultural experiment stations operated by these universities in cooperation with the Federal and State Governments. Many research opportunities for teachers and students as well as full time positions are provided in experiment stations. Teachers specializing in other biological sciences, particularly those important to medicine, are most often employed in liberal arts institutions and in medical schools.

A large majority of the biologists in government agencies are employed in the Federal Government—principally in the Department of Agriculture, the Federal agency employing most entomologists, botanists, plant physiologists, plant pathologists, horticulturists, geneticists, animal husbandry specialists, and parasitologists. The Interior Department employs all the fish and wildlife biologists in the Federal Government. The Defense Department—mostly the Army—and the U.S. Public Health Service employ a good many pharmacologists, parasitologists, physiologists, entomologists, and specialists in other branches of biology; these two agencies, together with the Veterans Administration also account for 85 percent of the microbiologists in the Federal Service.

State Governments employ about half of all the fish and wildlife specialists, and a few horticulturists, agronomists, entomologists, husbandry specialists, and phytopathologists. City and county health departments employ a good many microbiologists to detect, control, and prevent disease.

Private industry is the second largest employer of pharmacologists and microbiologists and is a growing source of employment for agronomists, entomologists, and phytopathologists as well as other biological scientists. Most of the microbiologists and nearly all the pharmacologists in this field of employment work for pharmaceutical firms manufacturing biological products such as toxins, toxoids, antiserums, antibiotics, and similar products. Microbiologists and bacteriologists are also employed in the food industry and in firms manufacturing tobacco, leather, organic acids, and other industrial products. Entomologists are employed mainly in the food industry to develop methods of protecting stored foods from insect pests, and in the chemical industry to do research in developing and testing insecticides. Phytopathologists are most often employed by firms manufacturing agricultural chemicals to combat plant diseases.

Although the number of biological scientists employed in nonprofit organizations is small, these agencies account for roughly 30 percent of the specialists in pathology and biophysics and 20 percent of the microbiologists. They also provide some employment opportunities for specialists in other branches of biology.

Training and Other Qualifications

Graduate training is necessary for employment in most professional positions in the biological sciences. The doctorate is generally required to achieve full professional recognition and is practically a prerequisite for higher level administrative and college teaching positions and for basic research in the field of experimental biology. The Ph. D. is increasingly a requirement for other positions involving independent research.

Biologists holding the master's degree are qualified for most entry positions in their specialty; they are also qualified for college teaching and basic research. Most biologists with this level of education work in colleges and universities or in government agencies. They are also frequently employed in related fields such as agricultural extension work and high school teaching.

Many of the biological sciences, particularly those in the area of medical biology, offer opportunities for persons with bachelor's degrees to work as senior technicians. In some specialties, persons holding the bachelor's degree can become junior research workers or obtain other professional entry positions. However, promotional opportunities for those without graduate training are, except in unusual cases, restricted to intermediate level positions.

In general, those with a bachelor's degree are qualified for positions in their specialty involving inspection and testing, production and operations work, technical sales and service, routine research, and administrative duties in connection with the enforcement of government regulations. They may also be employed as high school teachers. A teaching certificate is required for positions in the public schools, however.

Biologists with a B.A. degree who have majored in entomology, fish and wildlife biology, microbiology, and the agricultural sciences have the widest range of entrance opportunities. Entomologists and those with substantial training in the plant sciences can qualify for positions with the Federal and State Governments in connection with plant disease and insect control programs as well as for insect control programs in private industry. Microbiologists with a bachelor's degree are frequently employed both in government agencies and in private industry where they are in demand as junior professional assistants and as technicians in work involving laboratory control over manufacturing processes.

Students planning a professional career in the biological sciences are advised to obtain, during the first 4 years of college, the broadest possible training in all branches of biology and in related sciences. The professional biologist must not only have an intensive knowledge of his own specialty but also a broad background in the fundamentals of biology and related sciences so he can do research and correctly interpret results of his studies and experiments. All students in the biological sciences need training in organic and inorganic chemistry, physics, and mathematics. They should also take courses which provide laboratory experience and at least one field course, in order to relate their observations in the classroom and laboratory to the functioning of living plants and animals in their natural habitat. Extensive training and practice in laboratory techniques and the use of laboratory equipment is especially important. Most research and teaching in the biological sciences require skill in laboratory work which can be developed only through practice. Such training may be a prerequisite for employment in many entry positions in the field of medical biology research. Students interested in experimental biological research need advanced training in chemistry, mathematics, statistics, and, in some cases, physics. Those specializing in agricultural and soil bacteriology need courses in botany and plant pathology as well.

Most colleges and universities offer an undergraduate major in biology or in one of the other biological or agricultural sciences. However, course offerings vary widely and students are urged to examine courses listed in college announcements very carefully in order to choose the college best suited to their needs. In general, the liberal arts colleges emphasize training in the basic biological sciences and in the medical aspects of biological science. The agricultural colleges, mostly State universities and land-grant colleges, emphasize training in agriculture and the agricultural sciences. The State universities and land-grant colleges offer special advantages to those interested in agricultural sciences and in entomology since their agricultural experiment stations provide many opportunities for practical training and research work.

Employment Outlook

Employment opportunities for biological scientists with graduate degrees are expected to be very good through the early 1960's. Employment opportunities for persons with a bachelor's degree in some areas of biology are also likely to be very good.

Although the increased demand for biological scientists in the 1960's is expected to apply to most specialties, the greatest rise in demand will be in experimental biology. Research into problems important to medicine is expected to increase very substantially and existing shortages of scientists with doctorates in microbiology, physiology, and pharmacology will probably be greatly accentuated. This research will also require many more biologists with lesser degrees qualified to act as junior professional assistants and as technicians. Bacteriologists and physiologists, already in short supply in 1958, are likely to find employment opportunities in experimental biology exceptionally good. The demand for biological scientists in other specialties will rise more moderately but will continue because of the increased need in college teaching and private industry. Shortages of personnel with a bachelor's degree in entomology or in plant sciences, qualified to aid in regulatory and control programs were reported in 1958; these shortages may continue unless there is an increase in the number of students who specialize in these subjects and who are willing to do the necessary traveling or moving.

In the long run, growth in research expenditures is likely to be the major factor tending to increase the demand for biological scientists. For these, as well as other scientists, expenditures for research and development have been rising since the end of World War II. In recent years, the Federal Government has given greatly increased support to research in the biological sciences, notably through the National Institutes of Health, the National Science Foundation, and the Department of Defense. The National Science Foundation increased its expenditures in support of basic research in the biological sciences from $1 million in 1952 to an expected $20 millions in the year 1958–59. Voluntary health agencies, such as the cancer, tuberculosis, and heart societies, are also giving increased support to basic biological research. Expenditures for medical research programs rose sixfold between 1940 and 1955—from $40 million to $240 million—and are expected to rise to more than $900 million by 1970.

In the agricultural sciences, the major rise in research expenditures occurred during World War II and shortly thereafter, and has continued slowly since that time. In some areas, such as animal husbandry and horticulture, a considerable expansion in basic research occurred during the mid-1950's; in other areas, particularly plant disease and insect control, increased research is likely to occur from time to time as new problems arise. Agencies and organizations engaged in medical or agricultural research usually have a particular objective which they seek to advance. However, the many different aspects of biological research lead to the support of a wide variety of projects and call for many types of biological scientists.

The number of biological scientists employed in private industry has been rising slowly but steadily during the past decade and more sharply during the mid-1950's. The potentialities of microbiological and bacteriological research for both industrial and medical applications are especially great and the trend toward increased expenditures for research and development activities in microbiology are likely to persist, creating new employment opportunities at all levels of training, but most especially for Ph. D.'s capable of undertaking independent research and directing the research activities of others. It also appears probable that the demand for biological scientists, particularly microbiologists, plant scientists, and entomologists will rise.

In addition to increased expenditures for research and development another important factor tending to increase demand for biological scientists will be the substantially larger college and university enrollments expected in the 1960's and thereafter. The resulting increase in demand for teachers will be to a large extent for Ph. D.'s, for whom college teaching is a major field of employment. However, there will also be an increase in college openings for qualified holders of master's degrees. (For the statement on College Teaching Opportunities, see index.)

The long-range outlook for employment opportunities in the biological sciences is one of substantial continued growth, although the rate of growth in various specialties will differ.

Earnings and Working Conditions

College graduates with bachelor's degrees majoring in the various biological sciences had average starting salaries ranging from approximately $350 to $390 a month early in 1958. The groups with the lowest average starting salaries were those with degrees in microbiology, nematology, or parasitology; those with the highest average starting salaries had degrees in entomology, wildlife biology or wildlife management, ecology, genetics, zoology, and general biology. Graduates with master's degrees had average starting salaries ranging from about $370 to $440 a month, depending on their specialty. The lowest salaries were in fishery biology and related subjects and the highest in plant science. These data include earnings of many graduates who were employed in business administration, selling or other types of jobs which could not be considered as being in the field of professional biology, but exclude the earnings of those who entered the Federal Government. Despite these limitations, the data provide a good indication of the salary levels prevailing for biologists entering the employment field in 1957.

In the Federal Government, early in 1959, inexperienced biological scientists with a bachelor's degree were eligible for starting salaries of $4,040 or $4,980, depending on their college record; inexperienced scientists with 1 year of graduate training were eligible to start at $4,980 and those with 2 years of graduate work, at $5,985. Biological scientists with the Ph. D. degree but no experience were eligible to start at $7,030. Pharmacologists who were in a special category, received higher starting salaries; those with 1 year of graduate training, $5,430; those with 2 years of graduate training, $6,285; and Ph. D.'s, $7,510.

Experienced biologists with a doctoral degree or a medical degree who were working in the field of experimental biology in 1957 had median earnings of $8,400, according to a survey by the Federation of American Societies for Experimental Biology. The survey covered more than 9,200 biologists with advanced degrees who specialized in physiology, biochemistry, pharmacology, pathology, nutrition, and microbiology. It indicated further that biologists in universities had the lowest median salary, about $7,700, and those in private industry the highest, about $10,500. Substantially higher salaries were paid for administrative than for research work.

Where To Go for More Information

American Institute of Biological Sciences,
2000 P St. NW., Washington 6, D.C.

Federation of American Societies for Experimental Biology,
9650 Wisconsin Ave. NW., Washington 14, D.C.

U.S. Department of Agriculture,
Washington 25, D.C.

U.S. Department of Health, Education, and Welfare,
National Institutes of Health, Bethesda 14, Md.

The U.S. Civil Service Commission, Washington 25, D.C., will furnish information on positions available in Federal Government agencies. (For further information on such positions and how to apply for them, see chapter on Government Occupations.)

SOCIAL SCIENCES

The social sciences are concerned with the whole range of human history and activities, from the origin of man to the latest election returns. Social scientists, however, generally specialize in one of several major branches of social science, each of which is a study of human behavior from a different viewpoint. Those specializing in anthropology study primitive tribes, reconstruct lost cities and civilizations, and are concerned with the cultures and languages of all nations. Economists study the ways in which men make a living and analyze the factors which help or hinder them in satisfying their material needs. Historians describe and interpret the events of the past. Political scientists are concerned with the problems of government. Sociologists deal with the behavior and relationships of groups, including the family, the community, minorities, and others.

Besides these basic social science fields, there are a number of closely related fields, some of which are covered in separate statements in this Handbook. (See statements on Statisticians, Psychologists, and Social Workers.)

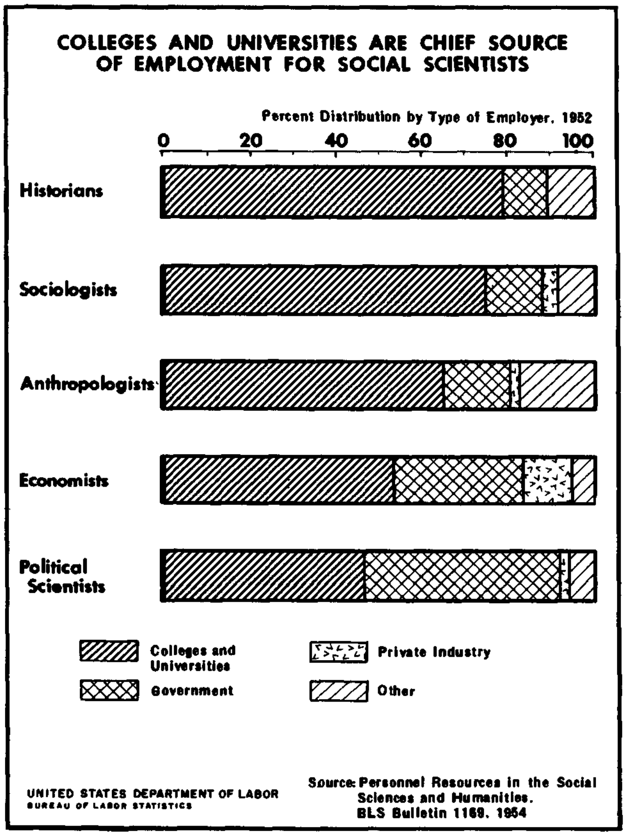
Based on information from a variety of sources, it is broadly estimated that about 40,000 people were professionally employed in the basic social sciences in 1956; fewer than 10 percent of the total were women. Because of overlapping—not only among the closely related basic social science fields but also with such fields as business administration, foreign service work, and high school teaching—it is extremely difficult to determine exactly the size of each social science profession. Economists are, however, the largest group of social scientists, followed by political scientists, historians, sociologists, and anthropologists.

The majority of all social scientists are employed by colleges and universities. (See chart 20.) The Federal Government is the second largest employer, especially of political scientists and economists. Except for economists, private industry employs comparatively few persons in professional social science positions, but there is a trend toward hiring increasing numbers of college graduates who have majored in the social sciences as trainees for administrative and executive positions in a variety of industries. Research councils and other nonprofit organizations provide an important source of employment for anthropologists and sociologists.

Training and Other Qualifications

Graduate training is required for most professional work in the social sciences. Completion of all requirements for the Ph. D. degree, except the doctoral dissertation, is commonly required for appointment to the position of college instructor in large colleges and universities, and the doctorate is a prerequisite for appointment to the rank of professor in many colleges and universities. Undergraduate training is sufficient for appointment to many beginning positions in the Federal Government, but persons with graduate degrees

CHART 20



may enter at a higher grade. Even in private industry, where a high proportion of currently employed social scientists have only bachelor's degrees, there is growing emphasis on the importance of graduate training for professional positions.

The great majority of all social scientists have graduate degrees. However, the proportion holding a Ph. D. degree varies considerably by field of specialization. For example, nearly 70 percent of the historians included in a recent survey had the Ph. D. degree, but only about 40 percent of the political scientists had attained the doctorate.

Employment Outlook

Employment in the social sciences is expected to increase substantially during the 1960's, largely because of the anticipated rise in the number of teachers in colleges and universities. (See statement on College and University Teachers, page 47.) Some increase in employment is also expected in both government and industry, as a result of the growing reliance on the use of social science methods in solving the economic and social problems of industry and the Nation. In addition to personnel required for new positions, about 1,500 social scientists will be needed each year to replace those who retire, die, or leave for other employment.

The supply of professional personnel in the social sciences comes largely from students obtaining graduate degrees. In the 10-year period ending June 1957, more than 40,000 master's degrees and 9,000 Ph. D. degrees were awarded in the social science fields. During the 10 years ending in 1967, it is estimated that more than 70,000 master's degrees and nearly 16,000 doctor's degrees will be granted. These estimates assume that the proportion of social science degrees granted will remain the same as during recent years and that college enrollments and graduations will continue to rise as rapidly as current forecasts suggest.

Employment opportunities for new Ph. D.'s will probably continue to be very good in most social science fields during the 1960's, despite the anticipated rise in the number of degrees granted in the social sciences. Economists with the Ph. D. degree and those with all the Ph. D. requirements except the doctoral dissertation are expected to find exceptionally good employment opportunities. It is likely that those with only a master's degree will also have very good opportunities, provided they are well trained in a particular specialty and in statistical research methods. In the other social science fields, those with only master's degrees may meet considerable competition for professional positions.

College graduates with only a bachelor's degree in the social sciences are likely to find opportunities for professional employment increasingly limited. Many of these graduates will probably find work in related fields of business or public administration, social work, and high school teaching; a considerable number will enter fields of work unrelated to their field of study. However, education in the social sciences has a basic value other than vocational training—that of helping individuals to meet their personal and social responsibilities in everyday living.

Earnings

Starting salaries for social scientists employed as instructors ranged from $4,000 to $5,000 in large colleges and universities in 1958, according to data from scattered sources. Generally, positions with the higher salaries required the Ph. D. degree, or completion of all requirements for this degree except the doctoral dissertation, and some experience—often obtained as a graduate teaching assistant. In a majority of colleges and universities, salaries of professors were 60 to 70 percent higher than instructors' salaries; in some very large universities, salaries were much higher. (See statement on College and University Teachers.)

Early in 1959, beginning salaries for social scientists entering the Federal Government in professional or administrative positions were $4,040 or $4,980 a year, depending on the college records of the applicants. Those with 1 year of graduate training were eligible for positions at an annual salary of $4,980; those with 2 years of graduate work were eligible to start at $5,985, and those with a Ph. D., at $7,030. All new candidates for entrance level positions were expected to meet the requirements of the Federal Service entrance examination. (See section on Government Occupations.)

The average (median) entrance salary of men graduates with a bachelor's degree who were employed as junior economists or statisticians in private industry was $354 a month in 1958, according to a survey by the Board of Examiners of the U.S. Bureau of the Census. However, most graduates with a major in economics entered selling, administrative, or accounting and fiscal work where median salaries ranged from $343 for accounting-type jobs to $386 for sales jobs. The highest earnings were received by a small group employed by large industrial corporations as production trainees; their median salary was $392. The lowest salaries were earned by those who went into elementary or high school teaching where the median salary was $300. Those in other types of professional work, including social work, averaged $331 a month. The median entrance salary of men graduates with a master's degree in economics was $440 a month in all types of employment. Salaries of other social scientists were believed to be comparable to those of economics majors for similar types of positions.

The latest comprehensive information on the earnings of social scientists is that obtained by the Bureau of Labor Statistics in a 1952 survey. Although earnings of social scientists are believed to have increased by 20 percent or more between 1952 and early 1959, the relative incomes of those in different types of work remained approximately the same.

Social scientists in fields which have a relatively high proportion of workers employed by the government and private industry earn more, on the average, than those in specialties largely confined to college and university employment. In 1952, median annual salaries of economists and political scientists were $6,500 and $5,900, respectively, and those of historians, sociologists, and anthropologists were $5,300 or less.

In all fields, social scientists with the Ph. D. degree earned substantially more, on the average, than did those with the master's degree, as shown in the following tabulation of median annual salaries received in 1952.

Occupation	*Master's degree*	*Ph. D. degree*
Anthropologists	$4, 500	$5, 800
Economists	5, 400	7, 200
Historians	4, 200	5, 500
Political scientists	5, 300	6, 100
Sociologists	4, 100	5, 800

Women social scientists, performing the same type of work as men, generally earn substantially less than men of comparable age, experience, and level of education. The 1952 survey indicated that women Ph. D.'s earned on the average about $1,000 less than men, even though they were an older, and presumably more experienced, group.

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Many social scientists earn income in addition to their regular salaries. Summer teaching is the principal source of such income in all fields, but consulting work is an important source of supplementary income for economists, political scientists, and sociologists. Income from royalties is a more common source of supplementary earnings for historians. Social scientists regularly employed by colleges and universities are the group most likely to have additional earnings. Comparatively few Federal Government employees have supplementary income.

Where To Go for More Information

Additional information on employment opportunities in the social sciences and related fields is given in the following publications:

Employment Outlook in the Social Sciences, Bureau of Labor Statistics Bulletin 1167, 1954. Superintendent of Documents, Washington 25. D.C. Price 30 cents.

Anthropology As a Career, Smithsonian Institution, Washington 25, D.C. Price 20 cents.

Career Opportunities in the U.S. Foreign Service, U.S. Department of State Publication 6566, 1958. Superintendent of Documents, Washington 25, D.C. Price 15 cents.

America's Helping Hand, International Cooperation Administration, Washington 25, D.C. Free.

The results of a survey of the characteristics and earnings of social scientists are published in the following report:

Personnel Resources in the Social Sciences and Humanities, Bureau of Labor Statistics Bulletin 1169, 1954. Superintendent of Documents, Washington 25, D.C. Price 70 cents.

Information on the respective branches of social science and on public administration may be obtained from the following professional organizations:

American Anthropological Association,
Logan Museum, Beloit College, Beloit, Wis.

American Economic Association,
Northwestern University, Evanston, Ill.

American Historical Association,
400 A St. SE., Washington 3, D.C.

American Political Science Association,
1726 Massachusetts Ave. NW., Washington 6, D.C.

American Sociological Society, New York University,
Washington Square, New York 3, N.Y.

American Society for Public Administration,
6042 Kimbark Ave., Chicago 37, Ill.

Anthropologists

(D.O.T. 0–36.01)

Nature of Work

Anthropology, the smallest of the social sciences, covers the widest range of subject matter. Anthropologists study primitive and civilized man, including his origin, physical characteristics, customs, traditions, material possessions, and social and religious organizations. It is estimated that only slightly more than a thousand persons, including archeologists, were professionally employed in this field in 1958. About a fifth were women—a higher proportion than in any other social science field.

Most anthropologists specialize in cultural anthropology—usually in either archeology or ethnology. *Archeologists* excavate the places where earlier civilizations are buried and reconstruct the history of the people who once lived there, by studying the remains of homes, clothing, tools, ornaments, and other evidence of human life and activity. For example, archeologists digging in the Near East are finding the earliest evidences of men turning to farming as a way of life. Other archeologists working in the Missouri Basin are salvaging remnants of Indian villages and sites of early military forts and trading posts before that area is flooded as a result of dams now under construction. The reconstruction of Williamsburg, Va., illustrates the work of archeologists in reconstructing the life of colonial America. *Ethnologists* may spend long periods living among primitive tribes or in other communities under difficult conditions, so they can learn their ways of life at first hand. The ethnologist takes accurate, detailed, and complete notes describing the social customs, beliefs, and material possessions of the people, usually learning their language in the process. He also collects examples of their pottery, tools, weapons, and other articles.

Few persons specialize as *physical anthropologists.* These anthropologists apply intensive training in human anatomy and biology to the study of human evolution, and to the scientific measurement of the physical differences among the races of mankind. Because of their knowledge of body structure, physical anthropologists are occasionally employed as consultants on such projects as the improvement of clothing sizes or the design of more comfortable furniture.

College teaching is the principal function of most anthropologists. However, research is the major work of nearly one-third of all anthropologists, including many in government agencies and nonprofit organizations, as well as a substantial proportion of those employed in colleges and universities. A good many are employed in museum work or administration. A few are engaged primarily in consulting, writing, or other activities.

Where Employed

The majority of anthropologists are employed in colleges and universities. Most teachers of

Anthropologists recording language in Bechuanaland.

anthropology are on the faculties of the small group of institutions (22 in 1957) which confer graduate degrees in anthropology. Some are in institutions that have combined departments of sociology and anthropology, and they may teach both subjects.

The second largest number of anthropologists are in the Federal Government, where they are employed mainly in museums and in Government supervised areas, such as parks, monuments, and trusteeship territories. During the past decade, there has been a considerable increase in the number of anthropologists employed in the Government, particularly in the National Park Service and Smithsonian Institution, as a result of the interagency archeological salvage program. This program, which covers every valley in the United States where water-control projects are, or will be, endangering archeological remains, is operated in cooperation with State and local organizations, particularly with State universities. A few anthropologists are employed—mainly as consultants—in other Federal agencies, including the Defense Department and the National Institutes of Health. Some are employed by State and local government agencies.

Nonprofit foundations and research organizations, which finance much of the field exploration done in foreign lands and in the United States, are an important source of employment for anthropologists.

Training and Other Qualifications

Persons with bachelor's degrees in anthropology may occasionally qualify for teaching assistantships or for positions as field or research assistants, particularly in connection with archeological studies. However, it is increasingly difficult for those without graduate training to obtain any but temporary positions in this field. The usual minimum entrance requirement for professional work in anthropology is a master's degree and some experience in field work. New graduates with master's degrees in anthropology may qualify for positions as instructors in colleges and universities and for entrance positions in research and administration or museum work. It is generally necessary to obtain the Ph. D. degree for better opportunities in all fields of employment.

Some training in physical anthropology and in archeology is necessary for all anthropologists. Courses in linguistics (the scientific study of language) are also valuable. Trained anthropologists are expected to obtain experience by doing basic research in the field. Undergraduate students may begin their field training as archeologists by accompanying expeditions as laborers. They may gradually advance to supervisory positions in charge of the digging or collection of material and may finally take charge of a portion of the work of the expedition. Beginning ethnologists usually do their field work alone, without direct supervision. Most anthropologists prepare doctoral dissertations based on data collected in the course of independent field research; they are, therefore, experienced fieldworkers by the time they obtain the Ph. D. degree.

The choice of a graduate school is very important, since the beginning anthropologist usually gets his first job through the anthropology department of the university from which he receives his advanced degree. Students interested in museum work should select a school which can provide experience in an associated museum having anthropological collections. Similarly, those interested in archeology should choose a university which offers opportunities for summer experience in archeological field work.

Employment Outlook

Employment opportunities for highly trained anthropologists are expected to be good throughout the 1960 decade. The number of anthropologists in colleges and universities will rise substantially. (See statement on College Teachers, p. 47.) Employment in fields of work other than teaching is expected to rise also, but more slowly. Anthropologists who have specialized in archeology and obtained some training in museum work will be in greatest demand for jobs outside the teaching field. Museums will need a somewhat larger number of curators than at present to care for growing collections of anthropological objects. The archeological salvage program will provide some new career positions, as well as a good many temporary jobs for university teachers and students. This salvage program will probably continue beyond the 1960's, as long-range plans for the construction of major highways and dams, canals, and other water-control projects are developed. Anthropologists will also find a few new opportunities in the field of mental and public health and in community survey work. In all other fields, new hiring is likely to be limited largely to the replacement of personnel retiring or leaving the field for other reasons.

Anthropologists holding the doctorate will probably have very favorable employment opportunities during the 1960's since the number of new Ph. D.'s is expected to remain below the demand for additional anthropologists during this period. Graduates with only the master's degree, however, are likely to face persistent competition for professional positions. Those who meet certification requirements may qualify for teaching positions. Others may find jobs in public administration and in nonprofit organizations and civic groups, which prefer personnel with social science training as a general background. (Information on Earnings and Where To Go for More Information is given at the beginning of this chapter.)

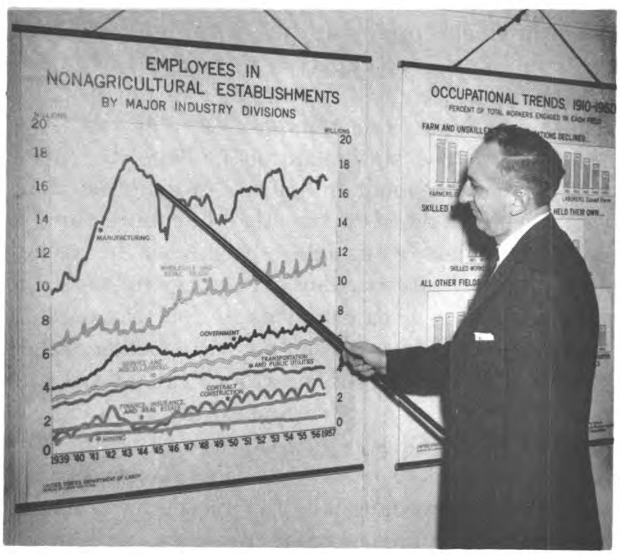
Economists

(D.O.T. 0–36.11)

Nature of Work

Economics is the largest of the basic social science fields, with about 17,000 persons employed primarily as economists in 1958. In addition, many other people not classified as economists were employed in work which required some training in economics.

Economists study the ways in which men make their living and the factors which determine their success or failure in satisfying their material needs. All economists must have a broad background in economic theory, economic history, and a knowledge of methods of economic analysis; most specialize in one or more fields in which economic principles are applied. Some economists are concerned with such problems as the control of inflation, the prevention of depression, and the development of farm, wage, tax, and tariff policies. Some develop comprehensive theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Others are concerned with the collection and interpretation of data on a wide variety of economic problems.



PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

An economist using statistical charts to explain employment trends.

Economists are employed principally as teachers in colleges and universities, as professional workers on economic research projects in government agencies, and, to a lesser extent, in private industry and nonprofit research organizations. (See chart 20.) Those employed as college teachers not only guide students in learning the basic principles and methods of economics but frequently engage in writing, lecturing, or consulting activities. They do much of the basic research on fundamental problems in economic theory and formulate many of the new theories and ideas which directly or indirectly influence economic thought in industry and government.

Most government economists do research and administrative work. They may plan and carry out studies involving the collection of basic economic data and may use these data to analyze problems in such areas as the consequences of changes in technology, industrial organization, government policy, or the demand for and supply of goods or manpower. They write reports on their findings and may be called upon to present reports before policymaking bodies. The largest numbers of economists in the Federal Government are specialists in agricultural, business, international trade and development, labor, and monetary and fiscal economics. In addition, many economists in the Federal Government are employed as statisticians, foreign affairs specialists, intelligence specialists, or as professional workers in other positions which require substantial training in economics.

Economists employed by large business firms, including banks and other financial institutions, perform mainly administrative and research duties. They may concentrate on problems relating to domestic business conditions, markets and prices of company products, government policies affecting business, or international trade. Their main purpose is to provide management with information to be used in making decisions on problems such as the timing of new financing or the advisability of expanding the company's business by adding new lines of merchandise or by opening branch plants in new areas. Some economists are self-employed and act as consultants, mainly to business firms.

Where Employed

About half the professional economists are employed by colleges and universities; approximately a third work for government agencies—primarily Federal; a small but growing number are employed by private industry; and a few serve in research agencies and community organizations.

Economists are found in nearly all university towns and cities. The largest number of economists are in the Washington, D.C. area, where more than three-fourths of the economists in the Federal Government are located. A good many economists are employed in foreign countries, mainly by the International Cooperation Administration. Economists in private industry are usually employed in cities where the home offices of large corporations are located. The New York City and Chicago metropolitan areas have the largest concentration of economists in private industry, as well as in nonprofit research organizations.

Training and Other Qualifications

A bachelor's degree with a major in economics is sufficient for many beginning research jobs in government and private industry, although persons employed in such jobs are not always regarded as professional economists. All economic research work requires a good background in the core subjects—economic theory, economic history, and statistics. Since beginners are usually concerned mainly with the collection and compilation of data, a thorough knowledge of statistical procedures is especially important. In addition, industrial and business firms often hire young people with bachelor's degrees in economics as management trainees, rotate them through various departments to acquaint them with company activities, and then assign them to positions where they are most needed or best fitted. Whether or not the employee is finally assigned a job which makes specific use of his training in economics depends largely on the needs of the company.

The master's degree is generally the minimum prerequisite for appointment to the position of college instructor, though graduate assistantships may be awarded to outstanding students working toward their master's degree. Completion of all the requirements for the Ph. D. degree, except the dissertation, is necessary for appointment to the position of instructor in many large colleges and universities. In government or private industry, economists with the master's degree can usually qualify for research-related positions of a somewhat higher level than those open to holders of only the bachelor's degree.

The Ph. D. degree is necessary for attaining a professorship in a high-ranking college or university and is an asset in obtaining many types of jobs, such as administrator or director of research projects in the government, a research council, foundation, or business organization.

Economists interested in overseas assignments will find broad training in other social sciences, as well as advanced training in economics, very helpful. For most positions with the International Cooperation Administration, considerable experience is also required.

The choice of a graduate school is very important for people planning to become economists. Students interested in research should select schools which emphasize training in research methods and statistics and provide good research facilities, including opportunities for practical experience. Those who wish to work in the field of agricultural economics will find exceptional opportunities for part-time research work at State universities having agricultural experiment stations. Professors and chairmen of economics departments do most of the placement of beginning economists in teaching positions and in positions in industry and nonprofit research organizations.

Employment Outlook

Employment opportunities for well-qualified economists are expected to continue to increase during the 1960 decade. Although inexperienced college graduates with only a bachelor's degree in economics will have few opportunities for employment as professional economists, they will probably continue to be in demand as market research assistants and as administrative and management trainees in industry and government.

Employment of economists will increase substantially in the college teaching field during the 1960's (see statement on College Teachers) and to a moderate extent in other fields. Colleges and universities may need 600 to 700 new instructors annually to handle rapidly increasing college enrollments and to replace faculty members who retire, die, or leave for other fields of work. Several hundred economists are also likely to be required annually to meet expansion and replacement needs in industry, government, and nonprofit organizations. Private industry is expected to employ a growing number of economists, as businessmen become more accustomed to relying on scientific methods of analyzing business trends, forecasting sales, and planning purchasing and production operations. Employment of economists in State and Federal Government is likely to increase somewhat to meet the needs of government and industry for more extensive data collection and analysis as a guide to policy planning. The demand for agricultural economists in the State agricultural experiment stations will continue.

Economists with the doctorate are expected to have the best opportunities for employment. The number of new Ph. D.'s is likely to be considerably less than the number of new college instructors needed during the 1960's. As a result, employment opportunities for economists who have fulfilled all requirements for the doctorate except the dissertation will also be very good. Although there may be considerable competition for professional positions among other economists with lesser qualifications—in view of the anticipated increase in their numbers—it is likely that most of those with graduate training will be able to find professional employment, especially if they have adequate training in statistics and mathematics. Those with only a bachelor's degree are likely to continue to find relatively limited opportunities for professional employment as economists. (Information on Earnings and Where To Go for More Information is given at the beginning of this chapter.)

Historians

(D.O.T. 0–36.91)

Nature of Work

Historians study the records of the past and write books and articles describing and analyzing past events, institutions, and ideas. They may specialize in the history of a specific country or region or in a particular period of time—ancient, medieval, or modern. Sometimes they study certain phases of history, such as the economic and social life of a country or period; international, diplomatic, military, church, political or cultural history, or other specialized areas. Most historians specialize in United States history or in modern European history. Some historians, usually called archivists, specialize in selecting, preserving, and making available documentary materials of historical value.

Most historians are employed as teachers in colleges and universities. (See chart 20.) Others are engaged in research and in archival, library, and museum work for government agencies, historical societies, special libraries, and private industry. Most college teachers also do historical research, writing, and lecturing, and are occasionally employed as consultants.

Government historians do mainly research, or administrative work and writing in connection with research projects. They examine, analyze, and evaluate original source materials—letters, memoranda, circulars, official records and reports, books, pamphlets, and articles—and prepare reports and special studies. Historians in the Defense Department may prepare confidential studies based on classified materials or may prepare pamphlets and books for publication. Others employed in the Defense Department, as well as in the State Department, are engaged in intelligence research or international relations work which requires training in historical research methods. Historians employed in the Department of the Interior do original research, prepare exhibits and talks, answer queries, and write pamphlets and historical handbooks describing events connected with the historic sites maintained by the National Park Service. Many historians in Federal and State agencies are archivists.

Historians employed in museums or special libraries may edit historical materials, prepare exhibits, and do related work. Some are experts in such areas as the development of various types of transportation (trains, cars, aircraft); others are specialists in colonial furniture, art, architecture, costumes, or other objects of historical interest.

Where Employed

An estimated 7,000 to 8,000 persons were employed as historians in 1958. This estimate does not include high school history teachers, who are usually classified as teachers rather than historians although some have had considerable training in history.

Approximately 80 percent of the historians were employed in colleges and universities. About 10 percent were employed in Federal Government agencies, principally the National Archives and the Defense Department. Small but growing numbers were employed by other government organizations (State, local, and international), by nonprofit foundations, research councils, special libraries, State historical societies, museums, and by large corporations.

Since history is taught in all institutions of higher education, historians are found in all college communities. About half the historians and three-fourths of those working as archivists in the Federal Government are employed in Washington, D.C. Historians in other types of employment usually work in localities which have museums or libraries with collections adequate for historical research.

Training and Other Qualifications

Graduate education is usually necessary to qualify as a historian. A survey by the Bureau of Labor Statistics of historians employed in 1952 indicated that more than two-thirds had doctorates and nearly all others had master's degrees. While a bachelor's degree with a major in history is sufficient training for many beginning jobs in archival work and may sometimes be accepted for other beginning positions in Federal, State, and local governments, persons in such jobs may not be regarded as professional historians. A major in history in college undergraduate work is often recommended by employing agencies for jobs in international relations and journalism.

Since beginning jobs open to college graduates with only a bachelor's degree in history are likely to be concerned with the collection and preservation of historical data, a knowledge of archival work is helpful. Graduate training or its equivalent in experience is required for advancement to higher level positions.

The master's degree in history is the minimum requirement for appointment to the position of college instructor, but the Ph. D. degree is necessary for appointment in many colleges and universities. The doctorate is indispensable for attaining high-level college teaching, research, and administrative positions in the field of history. Most historians in the Federal Government and in nonprofit organizations have a Ph. D. degree or the equivalent in training and experience.

Employment Outlook

Employment of historians is expected to increase moderately during the 1960's. Most of the new employment opportunities will be in college teaching. (See statement on College Teaching.) An average of 500 new instructors will probably be needed annually to teach new classes made necessary by expanding enrollments, and to replace those teachers who retire, die, or leave for other types of work. The number of positions for historians in archival work is also expected to rise, though more slowly than the number in college teaching. Only a slight rise is foreseen in the number of historians in other types of work.

Historians with doctorates are expected to have very good employment opportunities throughout the 1960 decade. Those with only the master's degree in history will probably encounter keen competition for professional positions, and those with only the bachelor's degree will find it increasingly difficult to advance to professional employment. On the other hand, history majors who meet certification requirements will find a good many openings in high school teaching. Some will also be able to qualify as trainees in administrative and management positions in government agencies, nonprofit foundations, civic organizations and, more rarely, in private industry. (Information on Earnings and Where To Go for More Information is given at the beginning of this chapter.)

Political Scientists

(D.O.T. 0–36.96)

Nature of Work

Political science is the study of government—what it is, what it does, and how and why. Political scientists are interested in government at every level—local, county, State, regional, national, and international. Many political scientists specialize in public administration, in American Government, or in international relations. Smaller numbers specialize in such fields as, public law, history of political ideas, political parties, public opinion, and area studies.

College teaching is the principal function of political scientists. However, substantial numbers do administrative or operational work, most frequently in the areas of personnel work, budget analysis, municipal administration, or international relations. A good many political scientists are engaged mainly in research, which may include, for example, surveys of the methods used by government agencies in carrying out legislation, studies of political developments in this country or abroad, or the analysis of the constitutionality of proposed legislation. Some political scientists act as consultants to college or municipal research bureaus, civic and taxpayers' associations, government agencies, and private research organizations. Others serve as legislative aids to congressmen or as staff members of congressional committees.

There were probably about 10,000 political scientists in 1958. However, it is exceedingly difficult to estimate the number of persons in this profession, since only those teaching political science in colleges and universities can be clearly identified. The field of applied public administration, in which many political scientists specialize, is very broad and political scientists frequently do work similar to that done by persons with training in many other fields, including the other social sciences, business administration, accounting, and law.

Where Employed

Approximately the same number of professional political scientists are employed by government agencies as are employed by institutions of higher learning. Fewer than 10 percent of political scientists are employed by all other types of employers, including nonprofit organizations and private industry.

Political science teachers are found in nearly every college community in the United States, since courses in political science and government are widely taught. Since most other political scientists are employed by government agencies, they are likely to be located in Washington, D.C., other large cities, or in State capitals. A good many are employed in overseas jobs mainly by the U.S. Department of State, International Cooperation Administration, and the U.S. Information Agency.

Training and Other Qualifications

Graduate training is generally required for professional employment in political science. College graduates with a master's degree in public administration can qualify for various administrative and research positions in government, and in nonprofit research and civic organizations. More than 100 colleges and universities offer graduate training in a wide range of topics in the field of public administration—city planning, municipal administration, criminal investigation, social security administration, and many more. A majority of these schools provide field training and many offer internships which enable the student to obtain experience in government work for a limited period. A good many universities award graduate degrees in international relations, foreign service, and area studies, as well as in the broad field of political science. A master's degree in any of these fields is very helpful in obtaining a position in a Federal Government agency concerned with foreign affairs. However, for some jobs, such as those with the International Cooperation Administration, only persons with substantial experience (preferably in public administration) are hired.

Completion of all requirements for the Ph. D. degree, except the doctoral dissertation, is the usual prerequisite for appointment as a college instructor. The Ph. D. degree is generally required for advancement to the position of professor.

Some young people with only a bachelor's degree in political science qualify as trainees for administrative jobs, such as budget analyst, personnel assistant, or investigator in government and industry. However, they must compete for these jobs with college graduates majoring in many other fields, particularly those with majors in business administration, accounting, economics, and other social science specialties. A great many students with the bachelor's degree in political science go on to study law; many others obtain graduate training in public administration, international relations, or other specialized branches of political science.

Employment Outlook

Rising employment of political scientists is expected throughout the 1960 decade. The largest increase in employment will be in colleges and universities. (See statement on College Teachers, p. 47.) However, the number of political scientists in administrative jobs in government agencies will also increase as a result of the widespread recognition of the value of specialized training in public administration. Government agencies concerned with foreign affairs will continue to use a good many political scientists, but changes in the employment of this group will depend on congressional appropriations. A slow growth is anticipated also in employment of political scientists in private industry, which uses some members of the profession as consultants on administration or on international problems affecting business. No substantial change is foreseen in the number of political scientists in other types of work.

Colleges and universities may need as many as 300 new political scientists annually during the 1960's, to teach additional classes and replace those who retire, die, or transfer to other fields of work. Several hundred more political scientists will be needed to meet expansion and replacement needs in government agencies. Political scientists with the doctorate will find very good employment opportunities in college teaching during this period. Persons who have completed all requirements for the doctorate except the dissertation should also find good opportunities in college teaching, if the proportion of students majoring in political science remains about the same as in the past decade.

Graduates with a master's degree in public administration will find many openings in a wide variety of administrative jobs in Federal, State, and municipal government agencies and nonprofit organizations. Political scientists with master's degrees in other specialties will also find some research and administrative jobs with government agencies, nonprofit research bureaus, political groups, and civic and welfare organizations.

New graduates with only the bachelor's degree will probably continue to find professional employment opportunities in the political science field limited. However, this background will be most helpful to those planning to continue their studies in law, foreign affairs, journalism, and other related fields. Some political scientists who meet State certification requirements will enter high school teaching. (Information on Earnings and Where To Go for More Information is given at the beginning of this chapter.)

Sociologists

(D.O.T. 0–36.31)

Nature of Work

Sociologists study the many groups which men form—families, tribes, communities, nations, and a great variety of social, religious, professional, business, and other organizations. They study the behavior of these groups, trace their origin and growth, and analyze their activities and the influence they have on their members. Some sociologists are primarily concerned with the characteristics of particular kinds of social groups and institutions; others are more interested in the ways in which individuals are affected by groups to which they belong. Many sociologists specialize in the study of social organization, social psychology, or rural sociology. Others specialize in intergroup relations, family problems, social effects of urban living, population studies, or analyses of public opinion. Some sociologists concentrate on research methodology or the conduct of surveys. Growing numbers are concerned with the application of sociological knowledge and methods in the areas of penology and correction, mental health, education, human relations in industry, and regional and community planning. The topics in which sociologists specialize are too many and varied to be fully listed here.

Most sociologists are college teachers. A large proportion of teachers also do research work, frequently for university-connected research bureaus. A growing number of sociologists are employed as research workers in government, business, nonprofit, and civic welfare organizations. Many are employed in administrative, management or operational activities, and small but expanding numbers are engaged in consulting work.

Sociological research involves the collection of data (often through personal interviews), the preparation of case studies, administration of tests, carrying out of statistical surveys, and laboratory experiments. Sociologists may make studies of individuals, families, or communities in an attempt to discover the causes of social problems—such as crime, juvenile delinquency, alcoholism, poverty, and dependency—the sources of family conflict, the normal pattern of family relations, or the different patterns of living in communities of varying types and sizes. They may collect and compile data from official government sources and make statistical analyses to show the trends in population growth and the extent of population movement in different parts of the country. Some sociologists are specialists in survey procedures, in such fields as public opinion research, market research, and methods of mass communication and advertising—including radio, television, newspapers, magazines, and circulars.

Sociologists in administrative work may supervise research projects or the operation of welfare agencies, or marriage and family clinics. Those in operational work may be employed as counselors, recreation workers, case workers, or probation and parole officers. Sociologists engaged in consulting work may give advice on such diverse problems as probation and parole procedures to be used in the treatment of delinquents, city planning, or the most effective methods of advertising to promote public interest in particular products.

An estimated 6,000 persons were professionally employed as sociologists in 1958. In addition, many persons were employed in positions requiring some training in this field, including many in social, recreation, and public health work. It is exceedingly difficult to estimate exactly the numbers of professional sociologists. Many sociologists outside the teaching field are classified under some other job title. In the Federal Government, for example, sociologists may be designated as social science analysts, public-welfare research workers, analytical and survey statisticians, and intelligence research specialists.

Where Employed

About three-fourths of the sociologists were employed in colleges and universities in 1958; approximately one-tenth were in Federal, State, local or international government agencies; about 5 percent were working in private industry or were self-employed; and the remainder were in nonprofit research or civic-welfare organizations.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. However, they are most heavily concentrated in large colleges and universities which offer graduate training in sociology and opportunities for sociological research at university-connected research bureaus. Rural sociologists most frequently work at State universities, because they are likely to have exceptional opportunities for research in this field at the State agricultural experiment stations attached to these universities. A small group of specialists in rural sociology and community development are employed in various parts of the world by the International Cooperation Administration.

Training and Other Qualifications

The master's degree with a major in sociology is the minimum preparation usually required for employment as a sociologist. The Ph. D. degree is frequently required for employment in the better positions. Young people with only a bachelor's degree in sociology are not considered qualified for professional employment, although they may be able to secure routine jobs in this field or in related fields where a knowledge of sociology is helpful. They may get jobs as interviewers or as research assistants working under close supervision. A good many are employed as case workers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. However, as a rule, welfare agencies prefer persons with specific training in social work. Sociology majors with sufficient training in statistics may obtain positions as beginning statisticians. Those who meet local certification requirements may enter high school teaching.

Sociologists with a master's degree may qualify for many administrative and research positions, provided they are trained in research methods and statistics. Such people perform work involving responsibility for specific portions of a survey or the preparation of analyses and reports under general supervision. They may advance on the basis of experience to supervisory levels in both public and private agencies. Sociologists with the master's degree may also qualify for some college instructorships. However, most colleges require training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students often get teaching or research assistantships while completing their training for a higher degree.

The Ph. D. degree is essential for attaining a professorship in most colleges or universities and is commonly required for sociologists who direct major research projects, hold important administrative positions, or act as consultants in government organizations, philanthropic or other welfare agencies, research foundations, marriage and family clinics, and business firms.

The choice of a graduate school is very important for people planning to become sociologists. Students interested in research should select schools which emphasize training in research methods and statistics and provide opportunities to gain practical experience in research work. Professors and chairmen of sociology departments frequently aid in the placement of graduates.

Employment Outlook

Employment opportunities for sociologists are expected to increase substantially during the 1960's. Most of the new positions will be in college teaching where rising numbers will be needed to handle expanding college enrollments. (See statement on College Teaching.) Perhaps as many as 300 new sociology teachers will be needed each year, on the average, to fill new positions and to replace college faculty members who leave the profession. A moderate rise in the number of sociologists in nonteaching fields is also anticipated.

Sociologists well trained in research methods and advanced statistics will have the widest choice of jobs. Employment opportunities are expected to be better than average for research workers specializing in the areas of social psychology, rural sociology, community development, and population and market research. Perhaps the greatest expansion in job openings will be in the field of correction, including prison administration. Employment opportunities will also increase markedly in other applied fields, such as the study of juvenile delinquency, mental health, and educational and industrial sociology.

The number of sociologists with the Ph. D. degree will rise more slowly than the demand during the 1960's, (assuming graduations in this field follow the expected trend in college graduaations as a whole). As a result, employment opportunities for both Ph. D.'s and those who have completed all requirements for the doctorate except the dissertation are expected to be very good during this period. New graduates with only the master's degree—with the exception of those specifically trained in research methods—will probably continue to face considerable competition for positions as professional sociologists. (Information on Earnings and Where To Go for More Information is given at the beginning of this chapter.)

THE CLERGY

The choice of the ministry, priesthood, or rabbinate as one's lifework involves considerations which do not enter into the selection of a career in most other occupations. When a young person decides to become a clergyman, he does so primarily because of his religious faith and his desire to help other people. Nevertheless, it is important for young people interested in becoming clergymen to have as much information as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel.

The number of clergymen needed is broadly related to the size and geographic distribution of the Nation's population and their participation in organized religious groups. These factors determine the number of churches and synagogues that are constructed and, thus, the number of pulpits to be filled. Since World War II, there has been a sharp rise in church and synagogue membership. According to the Yearbook of American Churches, slightly less than half the population in 1940 were members of religious groups; in 1957, more than 60 percent of the population were members. Altogether, more than 100 million people in the United States are reported to be members of organized religious groups. In addition to the clergymen who serve congregations, many are needed to teach in colleges and other educational institutions, to serve as missionaries, and to carry on a variety of functions in connection with religious activities.

A young person considering a career as a clergyman should seek the counsel of a religious leader of his faith to aid him in evaluating his qualifications for the profession. In addition to a basic desire to serve the spiritual needs of others and to lead them in religious activities, he will need a broad background of knowledge and the ability to speak and write clearly. Emotional stability is necessary, since a clergyman must be able to help others in times of stress. Furthermore, a young person should know that clergymen are expected to serve as examples of high moral character, and that the social and other activities in which they may participate are often influenced by the customs and attitudes of their community.

The amount of income a clergyman may receive varies greatly according to religious affiliation, location, and many other factors. In general, income depends largely upon the size and wealth of the congregation and is usually highest in large cities or in prosperous suburban areas. Earnings of clergymen, as of most other professional groups, usually rise with increased experience and responsibility. Most Protestant churches and some Jewish congregations provide their spiritual leaders with houses. Roman Catholic priests ordinarily live in the rectory of a parish church or are provided with lodgings by the religious community to which they belong. Many clergymen receive allowances for transportation and other expenses necessary in carrying on their work. Clergymen often receive gifts for officiating at special ceremonies such as weddings and funerals. In some cases, these gifts are an important source of additional income; however, they are frequently donated to charity by the clergyman.

More detailed information on the occupation of clergymen in the three largest faiths in the United States—Protestant, Roman Catholic, and Jewish—is given in the following statements which were prepared in cooperation with leaders of these faiths. Information on the clergy in other faiths may be obtained directly from leaders of the respective groups. Young people should also know that, in addition to the occupation of clergyman (as here described), there are numerous other church-related occupations—missionary, recreation leader, teacher, director of youth organizations, editor of religious publications, music director, and many others—which offer interesting and satisfying careers. The clergyman or educational director of a local church or synagogue can provide information on these occupations.

Protestant Clergymen

(D.O.T. 0–08.)

Nature of Work

Protestant clergymen lead their congregations in worship services and may administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give other talks; instruct people who are to be received into membership of the church; perform marriages; and conduct funerals. They counsel individuals who seek guidance, visit the sick and shut-in, comfort those who are bereaved, and serve their church members in countless other ways. Protestant ministers may also write articles for publication and engage in interfaith, community, and recreational activities sponsored by or related to the interests of the church. A few clergymen teach in seminaries, colleges, and universities.

The types of worship services which ministers conduct differ among Protestant denominations and also among congregations within a denomination. In some denominations, the minister follows a traditional order of worship, whereas in others the minister arranges the services to fit different occasions. Most of these services include Bible reading, hymn singing, prayers, and a sermon. Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service in some denominations.

Ministers serve congregations of varying sizes. In a small congregation, the minister will have greater opportunity to know his parishioners well. The minister of a big congregation usually has greater administrative responsibility in working with committees, church officers, and staff, in addition to his other duties as a pastor. He may have an associate or assistant who shares specific aspects of his ministry.

Where Employed

In 1958, more than 200,000 persons were serving as ministers of churches, representing over 225 Protestant denominations or other groups. In addition, several thousand ordained clergymen were in other occupations—many closely related to the ministry. The greatest numbers of clergymen are affiliated with the 4 largest groups of churches—Baptist, Methodist, Lutheran, and Presbyterian—to which 7 out of every 10 of the 60 million Protestant church members belong. Most ministers serve individual congregations; some are engaged in missionary activities in the United States and in foreign countries; others serve as chaplains in the Armed Forces, in hospitals, and in other institutions; still others teach in educational institutions, engage in other religious educational work, or are employed in social welfare and related agencies. Less than 5 percent of all ministers are women; however, many denominations ordain women. In addition, in some denominations an increasing number of women who have not been ordained are serving as pastors' assistants.

All cities and most towns have one or more Protestant churches with a full-time minister. The majority of ministers are located in cities and towns. Many others live in less densely populated areas where each may serve the religious needs of two or more congregations in different communities. A larger proportion of Protestants than members of other faiths live in rural areas.

Training and Other Qualifications

The educational preparation required for entry into the ministry has a wider range than for most professions. Some religious groups have no formal educational requirements, and others ordain persons who have received varying amounts of training in liberal arts colleges, Bible colleges, or Bible institutes. However, an increasingly large number of denominations require a 3-year course of professional study in theology following college graduation. After completion of such a course in a theological school, the degree of bachelor of divinity or sacred theology is awarded.

Seventy of the many theological institutions in the Nation were, in mid-1958, accredited by the American Association of Theological Schools. Accredited institutions admit only students who have received the bachelor's degree, or its equivalent, from an approved college. In addition, certain character and personality qualifications must be met, and endorsement by the religious group to which the applicant belongs is required.

The American Association of Theological Schools recommends that preseminary studies be concentrated in the liberal arts. Although courses in English, philosophy, and history are considered especially important, the pretheological student should take courses also in the natural and social sciences, religion, and foreign languages. The standard curriculum recommended for accredited theological schools divides the course of studies into four major fields: Biblical, historical, theological, and practical. Recent developments indicate that more courses in psychology, sociology, religious education, administration, and other studies of a practical nature are being included in the curriculum. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer the master of theology and the doctor of theology degrees to students completing 1 or more years of additional study.

In general, each denomination has its own schools of theology which reflect its particular interests and needs. However, there is a trend away from educating along strictly denominational lines; this has resulted in the opening of many Protestant theological schools to students from various denominations. Several nondenominational schools associated with universities give graduate training involving a wide range of theological points of view.

Among the personal qualifications which most denominations seek in a candidate for the ministry are a deep religious conviction, a sense of dedication to Christian service, a genuine concern for and love of people, a wholesome personality and Christian character, and a vigorous and creative mind. Because of the demands of the ministry, good health is a valuable asset.

Persons who have met denominational qualifications for the ministry are usually ordained following graduation from a seminary. In denominations which do not require seminary training, clergymen are ordained at various appointed times. Clergymen often start out as pastors of small congregations or as assistant pastors in large churches. Protestant clergymen in many of the larger denominations—especially those groups having a well-defined church organization—often are requested to serve in positions of great administrative and denominational responsibility.

Outlook

Shortages of Protestant ministers have persisted in the postwar period and are likely to continue through the early 1960's. However, not all Protestant denominations will have equal difficulty in filling vacant pulpits. Some denominations will probably have a sufficient number of people who are qualified to serve as ministers. Generally, those denominations which require many years of formal training to qualify for the ministry are having the greatest difficulty in filling the needs of all their churches, and this situation is likely to persist. Although total enrollment in Protestant theological schools has increased substantially in the past few years, the number of students graduated annually probably will not be sufficient to replace the thousands of ministers who retire or die each year, to meet the needs of newly established congregations, and to supply assistant pastors where needed.

Many churches—mainly those in rural areas—did not have a full-time ordained minister in 1958. A number of congregations had to rely on the services of theological students or shared the services of a pastor with another congregation. Some large churches were unable to fill openings for assistant pastors. In addition, ordained ministers were being sought to serve in foreign missions, in religious educational activities, and as chaplains in the Armed Forces and in hospitals, penitentiaries, and other institutions.

Over the long run, the total number of ministers needed by Protestant churches will become larger as a result of the expected growth in population and in the number of congregations. The greatest expansion is anticipated in the suburbs of large cities. The increasing opportunities for ministers in fields such as television and radio, youth and family relations work, the campus ministry, and religious activities in institutions and industry, also point toward a need for additional clergymen. Replacement of those removed from the ranks by death, retirement, or other causes will also require an ever-increasing number of newly trained ministers.

Where To Go for More Information

Young people who wish to enter the Protestant ministry should seek the counsel of a minister or church guidance worker. Additional information is also available from many denominational offices. Information on admission requirements may be obtained directly from each theological school.

Roman Catholic Priests

(D.O.T. 0–08.)

Nature of Work

Roman Catholic priests attend the spiritual, moral, and educational needs of the members of the Church. Their duties include offering the Sacrifice of the Mass; administering the Sacraments; visiting and comforting the sick, particularly those at the point of death; conducting funeral services and consoling survivors; counseling those in need of guidance; and assisting the poor. Priests give religious instruction at Mass in the form of a sermon. They have numerous other responsibilities to assure that all laws of the Church are fulfilled.

Priests spend long hours performing services to the church and the community. Their day usually begins with morning Mass and may end with an evening visit to the local hospital or the hearing of confessions. In addition, each day priests spend several hours in prayer and reading their breviaries. Many of them serve on committees or in civic organizations or otherwise assist in community projects. Various societies which carry on charitable and social programs also depend upon priests for direction.

Although all priests have the same powers acquired through ordination by a bishop, they are classified in two main categories—diocesan and religious—by reason of their way of life and the type of work to which they are assigned. Diocesan priests (sometimes called secular priests) generally work as individuals in the parishes to which they are assigned by the bishop of their diocese. Religious priests are members of religious orders—for example Jesuits, Dominicans, or Franciscans—and generally work as members of a community in specialized activities, such as teaching or missionary work, assigned to them by the superiors of the orders to which they belong.

Both religious and secular priests teach in and administer the various seminaries throughout the country, many of the Catholic universities and colleges, and some high schools. Priests attached to religious orders staff a larger proportion of the institutions of higher education and many high schools, whereas secular priests are primarily concerned with the parochial schools attached to the parish church and diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and the foreign field.

Where Employed

About 50,000 priests served the more than 35 million Catholics in the United States in 1958. There are priests in nearly every city and town and in many rural communities; however, the majority are in heavily populated metropolitan areas, where most of the Catholic population is located. Catholics are concentrated in the Northeast and the Great Lakes region, with smaller concentrations in California, Texas, and Louisiana. A large number of priests are located in communities near Catholic educational and other institutions. Many are stationed throughout the world as missionaries. Others travel constantly while giving missions to local parishes throughout the country. Some priests serve as chaplains with the Armed Forces or in hospitals or other institutions.

Training and Other Qualifications

The course of study for the priesthood takes at least 8 years after graduation from high school. Most students take this training in theological seminaries—first, in a minor seminary (usually for 2 years), then in a major seminary which offers 6 years of advanced training. As of January 1958, almost 37,000 students, known as seminarians, were enrolled in about 500 seminaries in the United States. High school graduates with the desired scholastic background—an academic course, including Latin—can complete the minor seminary in 2 years and then advance to the major seminary. Elementary school graduates can enter the minor seminary and complete high school as well as the 2 years of college work. Courses include Christian doctrine, Latin and Greek, English and at least one other modern language, rhetoric and elocution, history and geography, bookkeeping, mathematics and natural sciences, and Gregorian chant.

At the major seminary, the first 2 years are devoted to the study of philosophy, scripture, church history, and the natural sciences as related to religion. During the remaining 4 years, the course of study includes sacred scripture; apologetics; dogmatic, moral, and pastoral theology; homiletics; church history; liturgy; and canon law. Diocesan and religious priests attend different seminaries, where slight variations in the training reflect the differences in the type of work expected of them as priests. During the later years of his seminary course, the candidate receives from his bishop a succession of orders culminating in his ordination to the priesthood.

Most postgraduate work in theology is taken either at Catholic University of America (Washington, D.C.) or at the ecclesiastical universities in Rome. Many priests also do graduate work at other universities in fields unrelated to theology. Priests are commanded by the law of the Catholic Church to continue their studies, at least informally, after ordination.

Young men are never denied entry into seminaries because of lack of funds. In seminaries for secular priests, the bishop may make arrangements for loans to the students. Those in religious seminaries are often financed by contributions of benefactors.

Among the qualities considered most desirable in candidates for the Catholic priesthood are a love of and concern for people, a deep religious conviction, a desire to spread the Gospel of Christ, at least average intellectual ability, capacity to speak and write correctly and fluently, and more than average skill in working with people. Candidates for the priesthood must understand that priests are not permitted to marry and are dedicated to a life of chastity.

The first assignment of a newly ordained secular priest is usually that of assistant pastor or curate. Newly ordained priests of religious orders are assigned to the specialized duties for which they are trained.

Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual and educational needs of the rising number of Catholics in the Nation. Although the number of seminarians has increased steadily since World War II, the number of ordained priests has not been sufficient to fill the needs of newly established parishes and expanding colleges and other Catholic institutions, and to replace priests who die. Priests usually continue at their posts longer than persons in other professions, but the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been serving in many diverse areas—for example, religious radio and television work and labor-management mediation. Continued expansion of such activities, in addition to the expected further growth in Catholic population, will require a steady increase in the number of priests, both in the next few years and over the long run.

Where To Go for More Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priest. Additional information regarding different religious orders and the secular priesthood, as well as a list of the various seminaries which prepare students for the priesthood, may be obtained from Diocesan Directors of Vocations.

Rabbis

(D.O.T. 0–08.)

Nature of Work

The rabbi is the spiritual leader of his congregation and a teacher and interpreter of Jewish law and tradition. It is customary for the rabbi to conduct services daily and hold special services on the Sabbath and on the High Holy Days. In general, rabbis are available at all

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times to members of their congregations, other followers of Judaism, and the community at large. Many of the rabbi's functions—preparing and delivering sermons, performing wedding ceremonies, visiting the sick, conducting funeral services, comforting mourners, helping the poor, supervising religious education programs, engaging in interfaith activities, assuming community responsibilities, counseling individuals who seek guidance, and others—are similar to those performed by clergymen of other faiths. Rabbis may also contribute to religious and lay publications, and teach in theological seminaries, colleges, and universities.

Rabbis serve congregations affiliated with one of the three branches of American Judaism—Orthodox (traditional), Conservative, or Reform (liberal). Regardless of their particular point of view, all Hebrew congregations preserve the substance of Jewish religious worship. The congregations differ in the extent to which they adhere to the traditional form of worship—for example, in the wearing of head coverings or in the use of Hebrew as the language of prayer and music. Because of these differences, the format of the worship service and therefore the ritual of the rabbi may vary considerably—even among those congregations which belong to the same branch of Judaism.

Where Employed

Approximately 3,600 rabbis served the more than 5 million followers of the Jewish faith in this country in 1958. A substantial majority are Orthodox rabbis; the remainder are divided almost equally between the Conservative and Reform branches of Judaism. Most rabbis act as the spiritual leaders of individual congregations; some serve as chaplains in the Armed Forces and in hospitals; others teach either full or part time in private educational institutions; and others are employed in social welfare agencies and in religious education work for such organizations as Hillel Foundation.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated, of course, in those States which have sizable Jewish populations. In 1957, six States (New York, California, Pennsylvania, New Jersey, Illinois, and Massachusetts) had about four-fifths of the estimated total Jewish population in the United States.

Training and Other Qualifications

To become eligible for ordination as a rabbi, the student must complete the prescribed course of study at a Jewish theological seminary.

Entrance and training requirements differ among the seminaries, depending chiefly on the branch of Judaism with which the particular seminary is associated. The Hebrew Union College–Jewish Institute of Religion (Reform) and The Jewish Theological Seminary of America (Conservative) are the only seminaries which train rabbis for their respective groups. Both these schools require the completion of a 4-year college course, as well as prior preparation in Jewish studies, for admission to the rabbinic program which leads to ordination. Although 5 years are normally required to complete the rabbinic course at the Reform seminary, it is possible for exceptionally well prepared students to shorten this period of study to a minimum of 3 years. The course at the Conservative seminary may be completed in 4 years if the student has a good background in Jewish studies; otherwise, the course may take as long as 6 years.

Several institutions train Orthodox rabbis. These schools have programs of various lengths, all leading to ordination. At one of the larger Orthodox seminaries, well-qualified students who are college graduates may complete the rabbinic program in 3 years; however, students who are not college graduates may spend a longer period at the seminary and complete the requirements for the bachelor's degree at the same time they are pursuing the rabbinic course.

In general, the curriculums of Jewish theological seminaries provide the student with a comprehensive grasp of all aspects of Jewish knowledge, including the Bible and Talmud (Jewish civil and canonical law). Other courses include Jewish history, theology, pastoral psychology, and public speaking. The Reform seminary places less emphasis on the study of Talmud and has a broad course of study which includes such subjects as human relations and Jewish religious education. Some seminaries grant advanced academic degrees in such fields as Talmudic and Biblical research. All Jewish theological seminaries make scholarships and loans available to students.

Newly ordained rabbis usually start out as the leaders of small congregations or as assistants to experienced rabbis. As a rule, the pulpits of large and well established synagogues and temples are filled by experienced rabbis.

The choice of a career as a rabbi should, of course, be made on the basis of a desire to serve the religious needs of others. In addition to possessing such personal qualifications as high moral and ethical values, the prospective rabbi should be able to write and speak clearly, correctly, and logically.

Outlook

A sufficient supply of rabbis to fill the needs of all the congregations desiring their services is not likely to be available during the 1960 decade. Although the number of students graduating annually from the Jewish theological seminaries is expected to increase somewhat, the numbers will probably not be adequate to replace the rabbis who retire or die, and to fill the openings which will be created by the formation of new congregations. Immigration, once an important source of supply for rabbis, is no longer significant. In fact, graduates of American seminaries are now in demand for Jewish congregations in other countries.

As of 1958, many congregations—especially those located in States where there are relatively few persons of the Jewish faith—could not secure the spiritual leadership of a full-time ordained rabbi and had to rely on the services of senior theological students and lay readers. Rabbis were also being sought to lead the many new congregations which had been organized in and around New York, Chicago, Los Angeles, Philadelphia, and Boston—where the majority of the Jewish population is concentrated.

The striking increases since World War II in Jewish religious affiliation and in the number of synagogues and temples seem likely to continue over the long run. Factors indicating further growth in the need for rabbis include the anticipated increase in population and the establishment of many new households, particularly in the suburbs of large cities where most of the new congregations will be formed.

Where To Go for More Information

Young people who are interested in entering the profession should seek the guidance and counsel of a rabbi. Additional information on how to prepare for service in the rabbinate of a particular branch of Judaism, including admission requirements, may be obtained from each theological school.

TECHNICIANS

Technicians who work with engineers and physical scientists are among the fastest growing occupational groups in the United States. In recent years, the needs of the Nation's defense program, added to those of the expanding civilian economy, have greatly intensified the demand not only for engineers and scientists but also for technical workers with less training—the technicians with whom this chapter is concerned. These technicians, whose jobs generally require a combination of basic scientific and mathematical knowledge and manual skill, participate in research and development work, and in designing, producing, and maintaining the machines and materials of our increasingly complex technology.

This chapter covers those technicians who work with engineers and physical scientists, and includes a general discussion of the work of technicians and information on some of the specialized areas in which technicians are trained and employed. At the end of the chapter there is a separate report on draftsmen, who make up the largest and one of the oldest groups of the technician occupations.

The nature of the work performed by technicians varies tremendously among industries and among plants in the same industry. Even within a single plant, some technicians may perform relatively simple routine tasks, while others do work of a highly technical nature, which sometimes overlaps the functions of the engineer. Because of the great variety of jobs included in the technician category, it is difficult to give an overall description of their work. Some technician jobs require the ability to analyze and solve problems. Some require considerable aptitude in mathematics and the ability to visualize objects from drawings. Design jobs often require creative ability. Other technician jobs require knowledge of one or more of the skilled trades, although not necessarily the ability to perform as a craftsman. Still other jobs demand extensive knowledge of industrial equipment and processes. Sometimes jobs held by technicians are of a supervisory nature and require both technical knowledge and the ability to handle people.

There is little agreement among employers on either job titles or duties of technicians. Trained technicians doing similar work may be given general titles, such as engineering aid, junior engineer, physical science aid, or laboratory assistant, or such specific titles as time-study analyst or tool designer. Many groups concerned with the training of these personnel advocate use of the term "engineering technician" or "scientific technician" to refer to persons in jobs requiring post-high-school technical training, such as that provided by a technical institute, or its equivalent in experience.

Technicians Who Work With Engineers and Physical Scientists

Nature of Work

The term "technician" is used to describe a large and loosely defined group of occupations at many levels of skill and with a wide variety of training requirements. In general, technician jobs fall between those of the skilled craftsman and the professional engineer or scientist. The work is technical in nature but narrower in scope than that of the engineer or scientist and has a practical rather than a theoretical orientation. Frequently technician jobs require use of complex electronic and mechanical instruments, experimental laboratory apparatus, drafting instruments, tools, and machinery. Almost all technicians must be able to use engineering handbooks and computing devices, such as the slide rule or calculating machines.

Technicians are utilized in virtually every activity where technical know-how is required. One of their largest and best known areas of employment is research, development, and design work. Technicians in this type of activity who have titles such as laboratory technician, physical science aid, or engineering aid generally serve as direct supporting personnel to engineers or scientists. They conduct laboratory experiments or tests; set up, calibrate, and operate instruments; and make calculations. They may work on the fabrication and assembly of experimental equipment and developmental models, do drafting, and, in some instances, do design work.

Technicians in jobs related to production usually follow a course laid out by the engineer or scientist, but they often work without close supervision. They may aid in the various phases of the production planning, such as working out specifications regarding needed materials and methods of manufacture. Sometimes technicians serve as production supervisors or inspectors, devise tests to insure quality control of products, or make motion and time studies designed to improve the efficiency of operations. They may also perform liaison work between departments such as research or engineering and production.

In the installation, operation, and maintenance of complex machinery and equipment, technicians often handle or supervise work that might otherwise have to be done by engineers. They frequently are responsible for "troubleshooting" and repair work requiring considerable theoretical as well as practical knowledge.

Technicians may also be employed as supervisors of construction projects, as technical representatives of manufacturers seeking to aid the customer in achieving maximum utilization of technical equipment, as salesmen of technical products, or as technical writers of specifications and manuals. Also, in many of these activities they perform duties which might otherwise have to be handled by an engineer or scientist.

The following sections describe a number of technician occupations in addition to that of draftsmen, which is described separately at the end of the chapter.

Aeronautical Technicians. Aeronautical technicians work with engineers and scientists in all phases of aircraft design, production, and sale. They work not only on conventional aircraft but also on helicopters, rockets, guided missiles, and spacecraft, and on propulsion systems and controls as well as aircraft structures.

Many aeronautical technicians serve as aids to engineers in design work and on other projects. Often they assist in preparing layouts of aircraft structures or equipment installations by collecting information, making calculations, and performing many other tasks. They work on projects involving stress analysis, aerodynamics, structural design, flight test evaluation, weight control, or propulsion problems. For example, under the direction of an engineer, a technician might be assigned the problem of estimating weight factors, centers of gravity, and other items affecting an airplane's load capacity. Other technicians working on engineering projects prepare or supervise the preparation of drawing of parts and assemblies, or check engineering drawings for technical accuracy, practicability, and economy.

In addition to engineering project work, technicians work on various aspects of the fabrication and assembly of aircraft and equipment. They may serve as production supervisors; estimate costs of material and labor needed to manufacture airplanes, parts, and equipment; or do inspection work. Technicians may also be responsible for liaison between the engineers who do the planning and developing and the workers who convert the engineers' ideas into finished products. As an airplane is built, the liaison technician checks it for conformance with specifications, keeps the engineer informed as to progress, and investigates any production problems that arise. He may recommend minor changes in the design, the materials used, or the method of fabrication, which would expedite production of parts or assemblies.

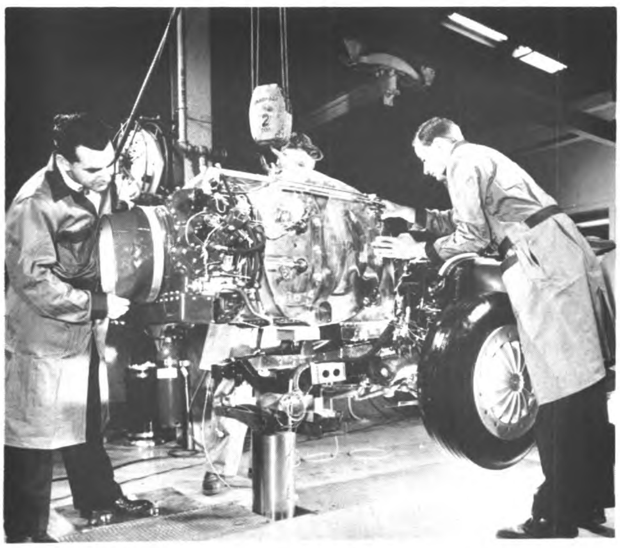
Some of the many other areas of work in which aeronautical technicians are employed include maintenance, field service, technical sales, and technical writing. Maintenance technicians inspect aircraft and engines and usually direct their servicing and repair. Those employed as manufacturers' field service representatives maintain liaison with the military services, commercial airlines, and other customers. Technicians with a flair for writing often prepare instruction manuals, bulletins, catalogs, and other technical materials. (Information on Airplane Mechanics appears elsewhere in the Handbook. See index for page number.)

Air-Conditioning, Heating, and Refrigeration Technicians. Heating, cooling, and refrigerating equipment is essential to health and comfort in our daily lives and to the operation of many factories, stores, and other businesses. Technicians in this field are concerned with the manufacture, installation, and servicing of this equipment. They often become specialists in one area of work, such as refrigeration, and sometimes in a particular activity, such as research and development, or design of layouts for heating, cooling, or refrigeration systems.

In the manufacture of air-conditioning, heating, and refrigeration equipment, technicians work in research and engineering departments, usually as aids to engineers and scientists. They also are frequently assigned such jobs as testing and inspecting equipment or analyzing production methods.

Technical sales work for manufacturers of equipment and for independent contractors who design and install systems is still another area of work for technicians. In such work they must be able to supply customers with information on such technical subjects as installation, maintenance, and operating costs and expected performance of equipment.

An air-conditioning, heating, or refrigeration system requires not only equipment for changing temperature but also duct-work or piping for distributing hot or cold air, hot water or steam, or refrigerating fluid. The design and installation of such systems is a large area of work for technicians. In designing the layout for an air-conditioning or heating system, the technician must determine the heating or cooling requirements, select the proper equipment to do the job, and estimate costs. In this work, he has to consider such problems as filtering air and controlling moisture, as well as heating or cooling. When a system is being installed, the technican may assist and supervise mechanics in installing motors, condensers, humidifiers, and other equipment, and in assembling and connecting piping and equipment. After the installation is completed and the control devices connected, he tests the units for proper performance. Technicians may also operate the equipment and supervise or perform maintenance and repair work, particularly where complex systems are involved. (Information on Refrigeration and Air-Conditioning Mechanics appears elsewhere in the Handbook. See index for page number.)



Automotive technicians assisting engineers in design and development work by building experimental equipment and testing it for performance, durability, and efficiency.

Automotive and Diesel Technicians. Automotive and diesel technicians perform many of the technical jobs necessary to produce and operate engines and related equipment for motor vehicles, locomotives, ships, commercial establishments, and industrial plants. The products on which they work include gasoline, diesel, and other types of internal combustion engines and related equipment, such as transmission systems, brakes, and clutches.

Technicians assisting engineers in design and development work may build and install experimental equipment and test it in the laboratory or on the road for performance, durability, and efficiency. As part of their job, they may record data, make computations, analyze results, and write reports. Their work often requires the understanding and interpretation of drawings, specifications, and instruments and gages, such as dynamometers, as well as the use of basic handtools. Some jobs require considerable knowledge of drafting techniques.

In manufacturing operations, some automotive and diesel technicians work as supervisors of production and assembly of engines and equipment; others test new engines as they come off the assembly line, do the more complicated inspection work, or serve as technical salesmen.

Automotive and diesel technicians may also be employed to operate complex engines and equipment and to supervise or perform maintenance and repair work. Although many operating and maintenance jobs can be handled by skilled workers, others require considerable technical background as well as manual skill and must be performed by trained technicians. (Information on Automobile Mechanics and Diesel Mechanics appears elsewhere in the Handbook. See index for page numbers.)

Chemical Technicians. Chemical technicians work with chemists and chemical engineers in the development, production, sale, and utilization of chemical products and equipment. They apply their knowledge of chemical and other physical science theory and of apparatus and equipment to such tasks as control of complicated chemical processes or laboratory research. The field of chemistry is so broad that technicians often become specialists in the problems of a particular industry and in an activity such as research or production.

Most chemical technicians are employed in research and development, testing, and other laboratory work. In research and development activities, technicians may assist chemists and chemical engineers in developing new products or improving existing ones. During the course of an experiment, the chemical technician may be called upon to do the computation work and to tabulate and analyze results. In testing work, technicians make chemical tests to determine compliance of a product with specifications. They analyze various materials to determine if particular substances are present and, if so, in what quantity. They may, for example, analyze steel for carbon phosphorous and sulfur content, or water for the amount of silica, iron, and calcium present. They also perform experiments to determine the characteristics of substances as, for example, viscosity and flash point of oil. The work of technicians employed in research or testing laboratories often requires the assembly and use of such apparatus and instruments as dilatometers, inferometers, analytical balances, and centrifuges.

In addition to those working in laboratories, many chemical technicians are employed to supervise various operations in the production of chemical products and sometimes as technical salesmen of chemicals and chemical equipment.

Civil and Construction Technicians. Civil and construction technicians perform many of the planning and supervisory tasks necessary in the construction of highways, railroads, bridges, viaducts, dams, houses, factories, and other structures. In the planning stages of construction, technicians may be engaged in estimating costs, purchasing materials, preparing specifications, surveying, drafting, or designing. Once the actual construction work has begun, technicians perform primarily supervisory functions, directing the crews engaged on the project. They may be responsible for seeing that construction activities are carried forward in proper order, and for inspecting the work as it progresses for conformance with blueprints and specifications.

Although civil and construction technicians are trained to perform many different tasks, they generally specialize in certain activities. For example, technicians working primarily as surveyors use the transit, the level, and other surveying instruments to determine the locations and measurements of land areas and buildings for construction and other purposes. As assistants to construction engineers, technicians help to make estimates of the costs, materials, and time necessary in the construction or repair of various structures. As highway foremen, they usually supervise the clearing of rights-of-way and the preparation of roads for surfacing. Many civil and construction technicians become specialists in some field of drafting, such as drawing plans for large buildings or preparing maps of cities and other areas.

Electric Power Technicians. Electric power is essential to the functioning of our technological society. Without it, there would be no electric lights, telephones, radios, television sets, or any of the numerous electrical appliances which enter into the daily lives of almost every American. Its absence would also halt virtually all industrial operations.

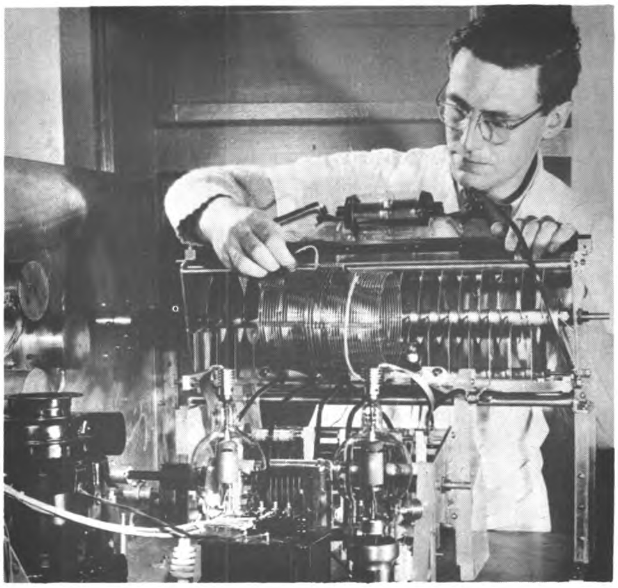
Technicians trained in the electric power field usually work in one of two major areas—the generation and distribution of electric power or the manufacture of electrical machinery and equipment. They may also work in the field of industrial electronics; for example, in connection with induction or dielectric heating, use of X-rays, diathermy, and ultrasonics. These jobs may sometimes overlap those of electronic technicians (described in the following section) who are chiefly concerned with equipment utilizing vacuum tube and semiconductor circuits. Other jobs in which electric power technicians are employed include supervising the installation of lighting systems in streets, factories, stores, and other large buildings and inspecting electric wiring for conformance with specifications and codes.

In companies which manufacture electrical equipment, these technicians may assist engineers in designing electric motors, generators, appliances, and other products. They may also perform experimental laboratory work or aid in solving problems connected with the manufacture of newly developed products. Others test the more complex products for conformity with designs and specifications while they are being manufactured or inspect finished products. Technicians working in equipment manufacturing companies may also prepare cost estimates for electrical installations; draft wiring diagrams of electrical machinery and control devices; do technical sales and field service work; and write technical manuals, reports, catalogs, or specifications.

In electric light and power companies, technicians may control the operation of power stations, substations, and transmission lines, or assist in doing this. They may be assigned such tasks as operating, inspecting, testing, overhauling, and changing generators, motors, transformers, automatic control systems, or other equipment.

Electronic Technicians. The electronic technicians considered in this chapter have a background of electronics theory, physical science, and mathematics which enables them to handle more complex and technical work than is involved in routine operating and repair jobs. The total number of electronic technicians employed at this level was estimated to be between 50,000 and 60,000 in 1958. (For additional information on jobs in the electronics field, see statement on Electronic Servicemen and Technicians. Refer to index for page number.)

The broad field of electronics in which these technicians work includes radio, television, telephony, and other forms of communication; industrial measuring, recording, indicating, and controlling devices; navigational equipment; guided missile controls; electronic computers; and many other types of equipment using vacuum tubes and semiconductor circuits. Because the field is so broad, technicians often become specialists in one area—for example, communications—and often in a subdivision such as radio or telephony.



Electronic technicians often work with intricate equipment such as this high power oscillator.

In general, electronic technicians apply their theoretical knowledge and their manual skills to such tasks as the preparation or interpretation of layouts and other diagrams, the design of electronic circuits, or the assembly, wiring, and installation of intricate electronic units. They may also diagnose the trouble in a piece of complex equipment, conduct tests to verify the diagnosis, and make necessary repairs. Their work often calls for use of engineering handbooks; oscilloscopes, signal generators, ohmmeters, multitesters, Q-meters, and other instruments; computing devices, such as slide rules; and basic handtools.

Electronic technicians employed in research activities usually assist scientists or engineers in building, testing, and sometimes, even designing experimental electronic apparatus. They may be called upon to devise practical solutions to problems of design, select suitable materials, determine the best method of building a piece of equipment, and evaluate the operating characteristics of the equipment after it is built.

In manufacturing operations, electronic technicians often supervise the production and assembly of electronic equipment. They may operate complex equipment, perform troubleshooting functions, or do the more complicated types of testing and inspection work. They also assist engineers in designing and setting up different types of testing equipment for use in manufacturing operations. (See also chapters on Occupations in the Aircraft, Missile, and Spacecraft Field; and Electronics Manufacturing Occupations.)

Electronic technicians are often employed in maintenance and repair jobs where knowledge above the routine repair level is needed. Electronic maintenance technicians employed by the new Federal Aviation Agency, for example, are responsible for keeping radar and other electronic equipment used to handle air traffic in perfect working order. Electronic technicians employed by the Department of Defense service radar, sonar, loran, and other warning and detection devices. Manufacturers and purchasers of electronic computers frequently employ electronic technicians to service and repair these complex machines.

Electronic technicians are employed in the engineering departments of radio and television broadcasting stations to operate and repair the electronic equipment in the studio and at the transmitter. Many are employed in supervisory jobs and, in some instances, may be responsible for the entire technical operation of the station. Technicians who operate transmitters must meet Federal Communications Commission licensing requirements. (For additional information on broadcast technicians, see chapter on Radio and Television Broadcasting Occupations. See index for page number.)

Industrial Technicians. Industrial technicians work with industrial engineers on problems involving the efficient use of men, materials, and machines in mass production processes. Their work includes such tasks as preparing layout of machinery and equipment, planning the flow of work, and making statistical studies and analyses of production costs to eliminate unnecessary expense. They may study different production methods and their costs in order to find out the best way of manufacturing a particular item.

The industrial technician may also assist the engineer in conducting time and motion studies. These studies involve timing and analyzing the movements workers make as they do their jobs. On the basis of information obtained, changes in tools and equipment used and a reorganization of operations to improve the arrangement of materials and the efficiency of body movements may be recommended.

Industrial technicians are sometimes employed as supervisors or foremen in manufacturing operations. In such jobs, they interpret blueprints, sketches, and written orders; determine work procedures; assign duties; inspect work; and maintain harmony among the personnel.

In the course of their duties, many industrial technicians acquire experience which enables them to qualify for other jobs. For example, those expert in machinery and production methods may move into the field of industrial safety. Others who specialize in job analyses may become involved in the setting of job standards and in the interviewing, testing, hiring, and training of personnel.

Tool Designers. The tool designer designs tools and devices for the mass production of manufactured articles. He originates and prepares sketches of the designs for cutting tools, jigs, special fixtures, and other attachments used in machine operations. He may also make or supervise others in the making of detailed drawings of these tools and fixtures. In addition to developing new tools, the designer frequently redesigns tools currently in use, in order to improve their efficiency. During the process of trying to develop the best tool for a particular purpose, the designer must often do some or all of the machine work involved in constructing working models.

In order to perform his highly technical job, the tool designer must have a practical and detailed knowledge of machine shop practice and drafting, and a good background in practical shop mathematics. He must also be familiar with the characteristics of the materials of which tools and fixtures are made. In addition, he needs a knowledge of manufacturing procedures and the merits of various methods of production, so that he can design tools which will serve to produce the article desired with minimum cost.

Other Technician Occupations. Many fields of work besides those described above offer opportunities for technicians with appropriate training. Those trained as metallurgical technicians, for example, work with metallurgists and metallurgical engineers in processing metals and in converting them into needed products. Some do testing or work in research laboratories; others serve as coordinators between departments of a plant or as inspectors. Mathematics aids, another technician group, assist mathematicians, engineers, and scientists by doing computations involving the use of algebra, logarithms, trigonometric functions, and higher mathematics. Still other fields of work for technicians are: cartography (mapmaking), gas turbine technology, optical technology, petroleum technology, photography, steam technology, textile technology, and welding technology.

As industry becomes increasingly mechanized, new technical occupations are constantly emerging. For example, instrumentation technology, a new and growing area of employment, has evolved from the introduction of more and more automatic controls and precision measuring devices in manufacturing operations. In industrial plants and laboratories, instruments are used to record data, to control and regulate the operation of machinery, and to measure time, weight, temperature, speeds of moving parts, electric current, strain, and pressure. Technicians—who may either have specific training in instrumentation or training chiefly in electronics, mechanics, or hydraulics—work with engineers and scientists in building, installing, and maintaining these highly complex devices and experimenting with them. The jobs of those employed in plants which manufacture instruments may involve the planning and estimating of time and material requirements and coordination work between the engineering department and the machine shop. (See also statement on Instrument Makers. Refer to index for page number.) Another new area of work for technicians, which has resulted from recognition of the need for a more scientific approach toward the reduction of industrial hazards, is safety technology. In the rapidly growing atomic energy field, technicians work with scientists on problems of radiation safety, inspection, and decontamination. (For a more detailed description of technicians employed in the atomic energy field, see chapter on Occupations in the Atomic Energy Field. See index for page number.)

Where Employed

In January 1957, nearly 575,000 technicians were employed in manufacturing and nonmanufacturing industries. The largest number, about 83,000, were employed in plants manufacturing machinery. The next largest number, about 74,000, worked for plants producing electrical equipment, and more than 50,000 were employed in aircraft and aircraft parts plants. Large numbers of technicians were also employed in the following industries: fabricated metal products and ordnance, chemicals and allied products, and telecommunications and broadcasting.

Research and development work is one of the major areas of employment for technicians. Of the nearly 575,000 technicians, approximately 160,000 were employed in this work in 1957. More than half of these technicians were in the aircraft and parts, electrical equipment, and machinery industries.

The Federal Government employs sizable numbers of technicians in times of peace as well as during emergency periods. Most Government technicians of the types covered in this chapter are in the following seven occupational categories: engineering aid, engineering draftsman, cartographic aid, cartographic draftsman, physical science aid, electronics technician, and mathematics aid. In addition, persons with training and experience as technicians may qualify for various mechanic and other blue-collar jobs in the Government service.

As of February 28, 1957, the Federal Government had 31,099 employees in the selected technician occupations mentioned above. About 19,000 or 60 percent of these technicians were working in the Department of Defense—in the Army, Navy, and Air Force. The Departments of Interior, Commerce, and Agriculture employed 10,700 technicians, or about 34 percent, and the remaining few were scattered throughout a number of other Government agencies.

Workers in each of the various technician specialties employed by the Federal Government were also largely concentrated in a relatively few agencies. For example, in 1957, about 94 percent of the 5,858 electronics technicians were employed by the Department of Defense in the Army, Navy, and Air Force, and by the Civil Aeronautics Administration of the Department of Commerce. Almost 40 percent of the 3,493 persons working as cartographic aids were employed by the Department of the Army; other agencies which employed large numbers of these technicians included the Departments of the Interior, Commerce, and Air Force. The Army and Interior Departments employed about 70 percent of the cartographic draftsmen. The Navy and National Advisory Committee for Aeronautics employed about 75 percent of the 571 mathematics aids.

Training and Other Qualifications

Young men and women who wish to prepare for careers as technicians can obtain formal education for this work from a number of sources including technical institutes, junior and community colleges, extension divisions of universities, and colleges offering 2-year technical programs. Training for technician jobs can also be obtained through programs operated by companies for their employees, and from correspondence schools, vocational schools, and a few advanced technical high schools. Not all persons who work as technicians have had specific training for their occupations. Engineering or liberal arts students who have not completed all requirements for a degree, some graduates of liberal arts colleges, and other persons with some post-high-school education in mathematics and science are often employed in technical positions. Many workers become technicians through on-the-job training and experience only.

The formal education given prospective technicians is designed to enable them to become productive as soon as they begin to work. It is expected that only a minimum of on-the-job training will be necessary to make them useful to employers. Schools preparing students for technician jobs give courses in applied science, applied mathematics, and applied engineering, with subject matter related to the practical problems students will face in the job. Students are also taught basic skills in the use of instruments, machinery, and tools. This training, however, is designed to familiarize the student with equipment rather than to develop manual skill. In contrast with the skilled craftsman whose job depends primarily upon his manipulative ability, a technician often uses instruments and machinery merely as an aid in applying his scientific knowledge to a particular problem.

Entrance requirements of schools specializing in education for technician jobs are usually less rigid and standardized than those of 4-year colleges. All institutions offering post-high-school technical training organize their courses for high school graduates. However, some admit students without a high school diploma if they have completed the equivalent of a full high school course, or if they satisfy age requirements, can pass special examinations or otherwise demonstrate their ability to perform work above the high school level, and can show that they are "adult, mature individuals" able to profit from the training offered.

The flexible entrance requirements of many of the schools offering education to prospective technicians make possible a career in the technical field for many persons who cannot meet the more rigid requirements for admission to regular 4-year colleges. However, young people should realize that the technical and scientific courses in most of these schools are of college level, and many institutions admit only high school graduates who have had mathematics and science courses. On the other hand, some schools have arrangements enabling students to make up deficiencies in these subjects. For all the occupations considered in this chapter, basic training in mathematics and science is essential, and students who expect to prepare for the technician field should, therefore, obtain a good background in these subjects in high school.

Because of the variety of educational institutions from which training may be obtained and differences in the kind and level of training offered, a person seeking a technical education should use more than ordinary care in selecting a school. If possible, information should be secured about State accreditation, professional recognition, the length of time the school has been in operation, instructional facilities, faculty qualifications, transferability of credits, and the success of the school's graduates. Students should also look into the costs of technical education and available scholarships and other financial aids. Above all, a student should realize that there is no quick and easy method of acquiring the background in mathematics, chemistry, and other physical sciences which will enable him to qualify as a technician.

A brief discussion of some of the types of educational institutions and other sources where young people can obtain training as technicians follows:

Technical Institutes. Technical institutes offer 1, 2, or 3 years of training above the high school level. Two years is the most usual training period.

The programs of technical institutes are usually designed to give the prospective technician an engineering and science background which prepares him for some specific job or cluster of related jobs. The scope of these programs is more limited than that required to prepare a person for a career as a professional engineer. Much emphasis is placed on laboratory and drafting work in order to familiarize students with instruments, equipment, and techniques used in industry. However, manual skills are not stressed as much as in vocational schools which prepare students for skilled jobs. In general, the student receives intensive technical training but less theoretical and general education than is provided by 4-year engineering and liberal arts colleges.

Some schools offer cooperative programs under which a student spends part of his time in school and part in employment related to the occupation for which he is preparing himself. It may take more than 2 years to complete the curriculum at a technical institute with a cooperative plan but this type of program gives students valuable experience in industrial situations, which often outweighs the disadvantages of a longer training period. In addition, students participating in cooperative programs frequently earn enough to pay for at least a part of their educational expenses.

Most technical institutes conduct both day and evening sessions. Evening classes are of particular importance to students who must have full-time jobs. By attending such classes, employed workers can often upgrade themselves to higher level technician jobs or obtain sufficient training to shift to a technician's job from another field of work. More than half of the students attending technical institutes in 1956 were enrolled part time in evening and special classes.

Some technical institutes give associate degrees which signify that the student has completed at least 2 years of college-level work. However, if the prospective student desires eventually to obtain a bachelor's degree from a 4-year college, he should investigate in advance whether his technical institute credits are transferable to the college of his choice. Although some colleges will give full credit for work taken at technical institutes, others will give either partial or no credit.

The amount of general education offered at technical institutes varies greatly. Some schools offer intensive training for technical occupations but almost no general education; whereas, other schools require their students to devote as much as 25 percent of their time to such courses as English and history, and 75 percent to specific courses in their vocational field.

Some technical institutes offering programs of the type described are operated as regular or extension divisions of colleges and universities. Others include separate institutions operated by States or municipalities, privately endowed institutions, proprietary schools, and YMCA schools. Altogether, there were about 71 technical institutes with a total of more than 67,000 full- and part-time students in 1955–56.

Junior or Community Colleges. Some of the approximately 625 junior or "community" colleges in the country also prepare students for technician occupations in industry and government. These schools usually offer 2 years of post-high-school education. It is common practice to award the degree of associate in arts upon completion of the 2-year program.

Not all junior colleges are equipped to give technical training of the type described in this report, nor do most of them consider this their primary purpose. Many of them do not have the shop and laboratory facilities nor the faculty required for thorough technical training. Furthermore, in contrast with most technical institutes which concentrate upon terminal education (after which the student is not ordinarily expected to take advanced work elsewhere), junior colleges also offer courses equivalent to those given in the freshman and sophomore years of 4-year colleges so that students completing this type of curriculum can, if they are properly prepared, begin with the junior year in a 4-year college. According to a United States Office of Education survey, there were, in the fall of 1956, 140 2-year colleges offering programs for training scientific and engineering technicians. These 140 colleges had more than 23,000 students enrolled in full-time study in technical programs and over 12,000 students studying on a part-time basis.

Junior college courses in technical fields are usually planned around the employment needs of the industries in the community where the college is located. The training programs for prospective technicians therefore vary and may be highly specialized. In some cases, the courses are designed to meet the specifications of one or two industries or even of a single plant. For example, in California, where the junior college movement has made great progress, several of the colleges in the southern part of the State offer technical training for jobs in the aircraft industry.

Many junior colleges are important adult education centers and offer extensive part-time courses at night. Through appropriate courses at junior colleges, as at technical institutes, workers may prepare themselves for higher grade jobs. Adults and special students accounted for more than half the total enrollment in junior colleges in 1955–56.

Training in Industry. Some large corporations conduct training programs for technicians. This type of training is primarily technical and rarely includes any general studies. Instruction is given both through formal classes and through training on the job. Workers who receive their training entirely on the job generally receive less theoretical training than those who receive formal instruction.

Other employers who do not have training programs, but are aware of the need for technically trained workers, often encourage their employees to attend classes in local schools or to enroll in correspondence courses. Employers sometimes ask the schools to arrange special educational programs which will expand the technical background of their employees. Some large corporations reimburse their employees for tuition after they have completed the course satisfactorily. The workers are usually expected to take courses directly related to their work assignment, and are sometimes allowed to attend classes on the employer's time.

Training for some occupations in the technician category may be obtained through a formal apprenticeship lasting 2 years or more. Occupations of which this is true include those of tool and die designer and draftsman. Supplementary education in mathematics and science is almost always necessary. Persons interested in apprentice training may obtain further information from the local office of their State employment service, directly from employers, or from the local labor union concerned with the occupation they wish to learn. High school graduates are usually given preference for openings. The age of apprentices at the start of training is generally from 18 to 22 years. However, the favorable experience that program sponsors had after World War II with somewhat older apprentices has caused many employers to relax age requirements.

Other Training. Although most of the jobs considered in this report require post-high-school education or the equivalent in experience, a few advanced technical high schools offer programs which qualify their graduates for entry jobs as technicians. These high schools have high admission requirements and offer more thorough and advanced courses in mathematics, science, drafting, and laboratory work than either an academic high school or a vocational school. Some schools have evening courses which may be organized as formal technical programs to prepare technicians or which may cover only a few subjects related to a particular area of work. These programs, like other evening courses, appeal especially to employed persons who wish to improve their job status by increasing their technical knowledge. Other technical high schools offer an additional year of schooling above the regular fourth year.

Correspondence schools and home study courses constitute additional sources of preparation for technicians. Persons who wish to learn more about their jobs or who wish to advance to a better job in the same field are the ones who derive the most benefit from such courses. Success in such courses depends greatly on the ability of the student to study by himself.

In addition to the sources of training already discussed, many thousands of technicians are trained each year by the Armed Forces. Each Military Establishment—Army, Navy, Air Force, Marine Corps—trains its own specialists. The Coast Guard also trains its own specialists. Some trainees are given intensive short courses; others receive extensive training of a year or more. Much of the training is transferable from military to civilian jobs, and indications are that a large proportion of the technicians trained by the military establishments utilize their training in civilian employment after they leave the Armed Forces.

Employment Outlook

The outlook is for continued expansion in employment of technicians in the years ahead. Technicians have been in recent decades one of the fastest growing occupational groups, and there is every indication of continued rapid growth in these occupations. Some of the major factors expected to raise the demand for technicians are continued growth of population and expansion of industry, and the increasing complexity of modern technology. The trend toward automation of industrial processes, the Nation's vast highway building program, and the growth of new areas of work, such as the atomic energy field and the earth satellite and other space programs, are expected to add to the demand for technical personnel. Increased emphasis on defense, particularly in the fields of aircraft, missiles, and electronics, will result in the growing need for technicians in these areas of work.

Also of great importance to the long-run growth in the employment of technicians is the prospect of a continued high level of expenditures for research and development in future years. More and more companies are establishing new research programs and strengthening existing programs to meet the strong competition in developing new products and processes. Furthermore, expenditures for defense-related research, which have loomed so important in recent years, are expected to continue at a high level. It is anticipated that technicians will be needed in large numbers in research, development, design, and other work which must precede the manufacturing process. As products and the methods by which they are manufactured become more complex, increasing numbers of technicians are also expected to be required in production, maintenance, technical sales, installation, and servicing jobs.

The number of job openings available to technicians in any one year will, however, reflect the general economic situation and changes that may occur in the Nation's defense program. A substantial increase in research and development, missile production or other aspects of the defense program, or an acceleration in other government programs such as public works would intensify the demand for technical personnel. On the other hand, if the defense program should be cut substantially, or the level of business activity should fall sharply, the demand for technicians would be reduced, and many would face competition for jobs from persons with other backgrounds, particularly professional workers.

Employment opportunities for well-trained women technicians have been good in recent years. In the past, women technicians have been employed chiefly in drafting jobs, in chemical and other laboratory work, and in computation and other work requiring application of mathematics. Over the long run, it is likely that more women will be trained and find employment in these and other technician occupations.

Earnings

In general, a technician's earnings depend upon his education, his technical specialty, and his work experience. Other important factors which influence his earnings are the type of employer for whom he works, the kind of work he does, and the geographic location of his job.

Information on the earnings of some types of technicians in private employment is available from a number of surveys in different industries and localities, though no nationwide studies have been made of technicians' pay. It should be noted that some of this information is based on surveys conducted in 1957; by the end of 1958, indications were that earnings in many technician occupations were slightly higher.

The salary ranges and the minimum education and experience needed for a young man to qualify for various positions in the aircraft manufacturing industry are shown in a 1957 study by the Institute of the Aeronautical Sciences. Data on several technician positions in this industry are given in the following table:

Occupation	Education requirements (above high school)	Minimum experience (years)	Monthly range of salaries (not including overtime or other adjustments)
Draftsman	2 years' engineering or comparable training.	0-3	$280-$485
Drawing checker (checks engineering drawings for accuracy and conformity to standards and specifications).	2 years' engineering or comparable training.	0-5	370- 750
Mathematician (sets up and solves math problems and analyzes technical data; develops formulas).	2 years' mathematics or comparable training.	0-3	300- 700
Production engineering liaison man (determines deviation between the specifications and the manufactured item and suggests revisions; interprets blueprints; etc.).	2 years' engineering or comparable training.	3-5	350- 750
Technical writer (prepares technical instruction manuals, catalogs, etc.)	2 years' engineering or comparable training.	0-4	325- 625
Standards analyst (investigates practicability of materials and parts; recommends standards; etc.).	2 years' college or comparable training.	0-3	325- 550
Tool designer (designs tools, fixtures, and special machines, working from blueprints and sketches).	2 years' engineering or comparable training.	2-8	375- 700
Weight analyst (calculates and estimates weight, balance, etc., for parts and assemblies).	2 years' engineering or comparable training.	0-4	325- 450

According to limited information from varied sources, earnings of electronic technicians working in aircraft manufacturing plants on the West Coast ranged from $2 to $3 an hour in 1958. These workers were among the better paid groups of electronic technicians employed in manufacturing industries.

The earnings of electronic technicians working in radio and television broadcasting stations vary greatly with the size of the station and of the community. Beginning salaries for these technicians ranged from about $50 to $75 a week in the small stations in 1958. Earnings of experienced men ranged from $80 a week in small towns to more than $150 in the large cities. Many technicians at the networks and large stations earned more than $185 a week. Supervisory technicians at the networks and large stations often earned in excess of $200 a week.

Further information on technicians' pay is available from studies of the 1957 earnings records of graduates of several technical institutes. For example, the Business and Technology division of Long Beach City College, Long Beach, Calif., reported starting salaries of $325 to $500 a month for its technician graduates. The Academy of Aeronautics, La Guardia Airport, N.Y., reported that its graduates were entering the aviation industry at salaries ranging from $400 to $500 a month. The Franklin Technical Institute and Wentworth Institute, both in Boston, Mass., report that their graduates in the various technical occupations were starting at $85 to $95 per week. The latter two schools reported that starting salaries offered their graduates in 1958 were about the same as in 1957.

The Federal Government classifies technician jobs, as it does other positions, in grades based on the difficulty and responsibility of the work. In general, technicians with 2 years of appropriate post-high-school training or experience can begin in jobs classified in grades 3 or 4 and may progress through grade 9. Some attain even higher grades.

The annual salary rates for grades 3 through 9, in effect since January 1958, follow:

Grade	*Salary range*
GS-3	$3,495-$4,065
GS-4	3,755- 4,325
GS-5	4,040- 4,940
GS-6	4,490- 5,390
GS-7	4,980- 5,880
GS-8	5,470- 6,370
GS-9	5,985- 6,885

An employee generally starts at the minimum salary for his grade, although in areas where there are acute shortages of personnel for certain positions, the Civil Service Commission may allow payment of entrance salaries above the minimum rate for the grade. After performing his job satisfactorily for 1 year, he may be promoted to the next grade: If he is not, he receives an ingrade salary increase, amounting to $95 in grades 3 and 4 and $150 in grades 5 through 9. After each additional year of satisfactory performance in the same grade, he receives another ingrade increase until the maximum for the grade is reached—after which he may receive further "longevity" increases at longer intervals.

Where To Go for More Information

General information on technician careers may be obtained from:

Engineers' Council for Professional Development,
29 West 39th St., New York 18, N.Y.

Technical Institute Division, American Society for Engineering Education,
University of Illinois, Urbana, Ill.

The President's Committee on Scientists and Engineers,
Washington 25, D.C.

National Council of Technical Schools,
1507 M St. NW., Washington 5, D.C.

Information on training opportunities may also be obtained from the Engineers Council for Professional Development, the nationally recognized accrediting agency for technical institute programs; the National Council of Technical Schools; and the sources listed above:

U.S. Department of Health, Education, and Welfare, Office of Education, Division of Higher Education, and/or Division of Vocational Education,
Washington 25, D.C.

Requests for information on training for technical occupations may be directed to either or both of these divisions of the Office of Education.

State departments of education at each State capital also have information about approved technical institutes, junior colleges, and other educational institutions offering post-high-school training for specific technical occupations. Other sources include:

The American Association of Junior Colleges,
1785 Massachusetts Ave. NW., Washington 6, D.C.

National Home Study Council,
1420 New York Ave., Washington 5, D.C.

To obtain information regarding apprenticeship opportunities in technician occupations, inquiries should be addressed to the Bureau of Apprenticeship and Training, U.S. Department of Labor, Washington 25, D.C., or to one of the regional offices of the Bureau or to the State apprenticeship agencies.

Information on medical laboratory technicians, medical X-ray technicians, and dental hygienists is presented elsewhere in the Handbook. (Refer to index for page number.)

The U.S. Civil Service Commission, Washington 25, D.C., will furnish information on positions available in Federal Government agencies.

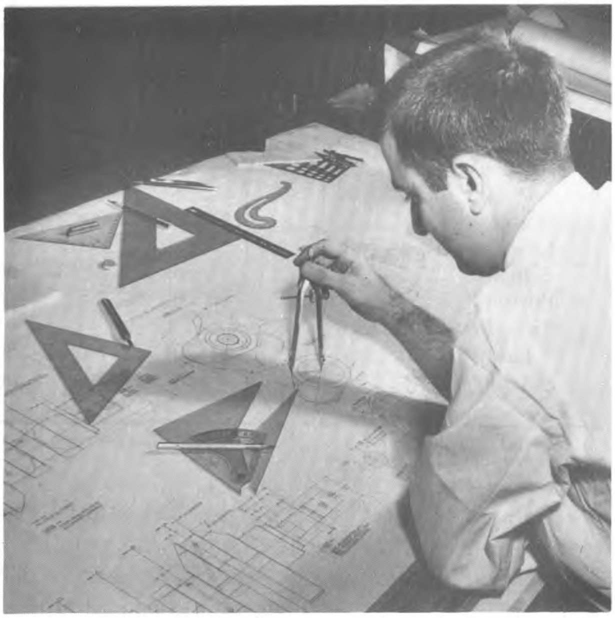
Draftsmen

Nature of Work

In making an airplane, a house, a ship, or almost any other product, manufacturing and construction companies need detailed plans giving dimensions and specifications for the entire product and each of its parts. The workers who draw these plans are draftsmen. They translate the ideas and calculations of engineers into complete and accurate working plans and detailed drawings which are used by the skilled craftsman in making the desired object.

Draftsmen in high-grade positions, such as that of design draftsman or senior draftsman, generally work from rough sketches, specifications, or field notes furnished by an engineer, architect, or designer. Their job is to transform ideas into actual drawings generally called layouts. They must have enough background in engineering and science so that the crude sketches of the design desired by the engineer will be truly represented in their drawings. They may be required to make calculations concerning the strength, quality, and cost of materials; to use engineering handbooks and tables for computations; and to have still other skills, including, of course, facility with drafting instruments and devices. In addition, draftsmen in high-level jobs must have enough shop experience so that they can, through their drawings and specifications, describe in detail materials and procedures for skilled craftsmen to use on a particular job. Some draftsmen in top positions do independent designing, act as supervisors, and may even assume the initiative and responsibility for starting and completing projects.

From the layouts prepared by design draftsmen, working drawings of details or parts of the machine or article to be manufactured or structure to be built, have to be made. Draftsmen who do this work are usually known as detailers. Their job also requires considerable experience and training. Other experienced draftsmen designated as checkers carefully examine each



Draftsmen translate the ideas and calculations of engineers into exact drawings.

drawing for errors. Tracers may also be employed to make corrections and to prepare drawings for blueprinting by copying them in ink on transparent cloth sheets, although, in recent years, photoreproduction of final pencil drawings has been rapidly eliminating the need for tracing in ink. Tracing is usually considered a beginning job for persons with little or no training or experience.

Practically all draftsmen specialize in some particular field of work. The largest fields are mechanical, electrical, aeronautical, structural, architectural, naval architectural, and topographical drafting.

Where Employed

About 125,000 draftsmen were employed in 1950, of whom 7 percent were women. Although no current statistics are available, there is evidence that the number of draftsmen employed is substantially greater today than in 1950.

The manufacturing industries which employ the most draftsmen include electrical equipment, machinery, aircraft and parts, fabricated metal products and ordnance, chemicals and allied products, petroleum products and extraction, professional and scientific instruments, and primary metals. Substantial numbers are also employed in the telecommunications and broadcasting, transportation and other public utilities, and construction industries. Many draftsmen work for engineering and architectural consulting firms, and sizable numbers are employed by Federal, State, and local governments. Of those employed by the Federal Government by far the largest number work for the Departments of the Army, Navy, and Air Force.

Training and Other Qualifications

A person can acquire the specialized training needed to become a draftsman from a number of sources, including technical institutes, junior colleges, extension divisions of universities, colleges offering special 2-year programs, technical high schools, correspondence schools, and trade schools. It is also possible to become a draftsman by serving a 3- or 4-year apprenticeship or by some other type of on-the-job training combined with part-time schooling. In any case, the training should include mathematics and physical sciences, as well as mechanical drawing.

Since many of the higher level drafting jobs require a knowledge of methods of manufacturing or construction, instruction in shop practices and even the actual acquisition of some shop skill are advantageous to the person interested in a drafting career. Many of the types of technical schools listed above offer training in various areas of

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technology which includes shop practice, and courses in engineering and science as well as instruction in drafting.

Draftsmen should have aptitude for detail and for visualizing objects of two or three dimensions. Artistic ability is not generally required but may be very helpful in some specialized fields. Good eyesight is important, since drafting involves close work.

Employment Outlook

Employment opportunities for well-trained draftsmen are expected to be favorable during the early 1960's, and continued expansion of employment is anticipated over the long run. As the engineering and scientific occupations grow, more draftsmen will be required as supporting personnel. Moreover, the industries employing most draftsmen are expected to expand further. With the increasing complexity of industrial operations, design problems will become more and more involved, adding to the need for well-trained draftsmen. In addition to draftsmen needed to fill new positions, many will be required each year to replace those who retire, die, or move into other fields. Losses to the occupation from retirement and deaths were estimated to be about 1,600 during 1958 and will rise slowly in the future.

This analysis, like that for most technician jobs, assumes a continued high level of employment and business activity in the country as a whole. It also assumes that Government spending for defense—a major factor affecting demand for draftsmen—will remain high. A substantial cut in defense spending or a sharp drop in business activity in the metalworking or construction industries would reduce the demand for draftsmen. On the other hand, a substantial increase in defense expenditures or an acceleration in highway or other public works programs would intensify the demand for draftsmen.

Earnings

Average straight-time weekly earnings of draftsmen surveyed by the Bureau of Labor Statistics between August 1957 and June 1958 were as follows:

Area	Draftsmen			
	Tracer	Junior	Senior	Chief or leader
Northeast:				
Boston	$59.00	$79.50	$107.00	$142.00
New York	78.50	84.00	126.00	159.00
Newark-Jersey City	------	80.00	107.50	126.50
Philadelphia	59.50	82.00	105.00	148.50
South:				
Atlanta	------	78.00	105.50	154.00
Baltimore	69.00	74.50	107.00	135.00
Dallas	61.50	74.00	92.00	114.50
Memphis	------	66.50	107.50	-------
New Orleans	------	75.50	109.50	-------
North Central:				
Chicago	70.00	87.00	121.50	140.00
Cleveland	84.50	91.50	117.50	141.00
Milwaukee	66.50	86.00	110.00	138.50
Minneapolis-St. Paul	61.00	80.50	101.50	-------
St. Louis	69.00	84.00	112.50	142.00
West:				
Denver	------	81.00	122.00	150.00
Los Angeles-Long Beach	------	85.00	111.50	141.00
Portland	------	88.00	105.00	-------
San Francisco-Oakland	------	85.50	108.50	124.00
Seattle	------	73.50	96.50	112.50

NOTE: Tabulation includes male draftsmen only. Dashes indicate insufficient data to warrant presentation.

In the Federal Civil Service, the annual entrance salary for trainee draftsmen who were high school graduates without experience was $3,255 in 1958. For those with post-high-school education and training in drafting, entrance salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between $4,000 and $5,900 in 1958, and some earned still higher salaries.

Where To Go for More Information

General information on drafting careers may be obtained from:

American Federation of Technical Engineers,
900 F St. NW., Washington 4, D.C.

The American Institute of Architects,
1735 New York Ave. NW., Washington 6, D.C.

See also section on Where To Go for More Information in the introductory section of this chapter.

OTHER PROFESSIONAL AND RELATED OCCUPATIONS

Accountants

(D.O.T. 0–01.)

Nature of Work

Accounting is the second largest field of professional employment for men. In 1958, nearly 400,000 accountants and auditors were engaged in professional accounting work, including about 60,000 certified public accountants (CPA's) who had passed rigorous examinations and met educational and experience requirements prescribed by law in their State. Fewer than 10 percent of all accountants, and 2 percent of the CPA's, were women.

Accountants compile and analyze business records and prepare financial reports, such as profit and loss statements, balance sheets, cost studies, and tax reports. The major fields of employment are public, private, and government accounting. Public accountants provide their services on a fee basis to various business enterprises and the general public. Private accountants, often referred to as industrial or management accountants, handle the financial records of a single business firm and work on a salary basis. Government accountants work on the financial records of government agencies or of private business organizations and individuals whose dealings are subject to government regulation.

Accountants in any field of employment may specialize in such areas as auditing, tax work, cost accounting, budgeting and control, or systems and procedures. Public accountants, however, are most likely to specialize in auditing or tax accounting; private accountants, in management or cost accounting. Many accountants in the Federal Government are employed as Internal Revenue agents, investigators, and bank examiners, as well as in regular accounting positions.

Where Employed

The majority of accountants are employed by private industry, with the greatest number in manufacturing establishments. Perhaps a third of all accountants, including a substantial majority of the CPA's, are in public accounting. Federal, State and local governments employ about one-tenth of the total.

Private accountants are found wherever large business or industrial establishments are located. Public accountants are mainly concentrated in major metropolitan centers, but the proportion in smaller communities is rising because growing numbers are going into business for themselves, and major national firms are continuing to open additional branch offices.

Training and Other Qualifications

Training in accounting is offered in a wide variety of institutions, including 4-year colleges and universities, junior colleges, accounting and private business schools, and correspondence schools. However, a bachelor's degree with a major in accounting or a closely related field is usually required for the better positions, particularly in public accounting. Four years of college education with 24 semester hours in accounting, or an equivalent combination of education and experience, is required for junior professional positions in the Federal Government. Practical experience is of great value in qualifying for professional accounting work. In 1958, more than 30 colleges offered internship programs in cooperation with public accounting firms, and occasionally with large corporations, which enabled students to obtain several months of experience, thus improving their job opportunities.

In all States, only those persons with CPA certificates issued by the State boards may call themselves "certified public accountants." In over half the States, the title "public accountant" is restricted to those who are licensed or registered. Information on registration and certification should be obtained directly from the State board of accountancy in the State where the student plans to practice. Nearly all States require at least 2 years of public accounting experience or the equivalent before the CPA certificate is issued.

Although most States have no specific educational requirement, the trend is toward requiring a 4-year college degree with a major in accounting. New York, New Jersey, Florida, and Connecticut require CPA candidates to be college graduates and similar requirements are pending in several other States. All States use the CPA examination provided by the American Institute of Certified Public Accountants. In recent years, a large majority of the successful CPA candidates have been college graduates.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to counting cash, verifying additions, or performing other detailed work. They usually advance to semisenior positions in 2 or 3 years and to senior positions within another 2 or 3 years. Those able to deal with top executives in industry may eventually become supervisors, managers, or partners in larger firms. Many become independent practitioners. Beginners in private accounting may start as ledger or cost clerks, timekeepers, junior internal auditors, or, occasionally, as trainees for technical and executive positions. They may rise to chief plant accountant, chief cost accountant, senior internal auditor, or manager of internal auditing, depending on their specialty, and some become controllers, treasurers, and even corporation presidents. In the Federal Government, new accountants are hired as trainees and are usually promoted in a year or less. Although advancement may be rapid for able accountants, particularly in public accounting, those with inadequate training are likely to be assigned to routine jobs with little opportunity for promotion.

Employment Outlook

The demand for accountants is expected to continue to be strong during the early 1960's. As many as 10,000 accountants may be needed annually during this period to replace those who retire, die, or transfer to other occupations, and more than half that number will be needed each year to fill new positions, unless there should be a major drop in the general level of business activity. Demand for college-trained accountants will rise faster than for less broadly trained personnel, because of the increasing complexity of the accounting profession and because more States are requiring CPA candidates to be college graduates. If the proportion of college graduates majoring in accounting remains the same as in recent years, the numbers receiving degrees in this subject field will rise gradually—from about 10,000 in 1957 to more than 15,000 by the mid-sixties. These graduates are likely to have very good employment opportunities, at least through the early 1960's, and graduates of private business and accounting schools should also have good job prospects during this period. The greatest number of jobs will continue to be in major industrial centers, but there will be many openings in small industrial communities.

Over the long run, accounting employment is expected to expand because of several factors: The greater use of accounting information in business management; complex tax systems; the growth in size and number of publicly held business corporations that must provide financial reports to stockholders; and the increasing use of accounting services by small business organizations. Highly trained accountants will be in even greater demand as consultants on management problems, such as planning of new recordkeeping systems and procedures for use with electronic data-processing equipment.

Increasing numbers of women will be engaged in professional accounting, though most public accounting firms still hesitate to employ them—because of tradition, objections from clients, or because women are considered unsuited for travel or factory assignments. However, those women who rank high among graduates with accounting majors and who secure the CPA certificate will, in time, undoubtedly break down many of these barriers.

Earnings and Working Conditions

Starting salaries for inexperienced professional personnel in public accounting firms in the New York metropolitan area averaged about $60 a week in small firms and $70 to $80 in medium-size firms late in 1958, according to local placement officials. In general, salaries were higher in large than in small firms throughout the country. Major CPA firms serving large business corporations were offering from $375 to $450 a month to college graduates with superior academic records and attractive personalities. Salaries of senior personnel with 5 years' experience were approximately 50 percent higher than the starting rate.

Private business firms usually pay somewhat higher starting salaries than public accounting firms of comparable size. A survey of 116 large business organizations recruiting college seniors mainly for industrial accounting positions indicated an average monthly starting salary of $416 in 1958.

The Federal Civil Service entrance salary in 1958 was $4,040 a year for junior accountants and auditors. Those with a superior academic record could qualify for a starting salary of $4,980. Higher level jobs are usually filled by promotion from within.

Since most public accounting work is done in the offices of the firm's clients, physical working conditions may vary from a modern office to an inconvenient, noisy factory. Public accounting work is seasonal and accountants usually work under great pressure during the busy season, from late November to March, and may put in a substantial amount of overtime. Working conditions for private and government accountants are generally the same as for most other officeworkers, including the standard workweek of 35 to 40 hours. Auditors in private industry and government and staff members of large public accounting firms may be required to do considerable traveling.

Where To Go for More Information

Information, particularly on CPA's and on the aptitude and achievement tests now given in many high schools and colleges and by many public accounting firms, may be obtained from:

American Institute of Certified Public Accountants,
270 Madison Ave., New York 16, N.Y.

Further information on specialized fields of accounting may be obtained from:

National Association of Accountants,
505 Park Ave., New York 22, N.Y.

Controllers Institute of America,
2 Park Ave., New York 16, N.Y.

The Institute of Internal Auditors,
120 Wall St., New York 5, N.Y.

A leaflet describing accounting as a career may be obtained free from:

The American Accounting Association,
P.O. Box 3068, University Station, Columbus 10, Ohio

Architects

(D.O.T. 0–03.10)

Nature of Work

Architects plan buildings and other structures and supervise their construction. Their goal is to design structures which are safe, useful, and pleasing in appearance.

When an architect receives a commission for a building, he confers with the client to determine the requirements and cost limitations of the structure as well as the client's preferences as to style and plan. For example, if a school is to be built, the architect must determine, among other things, the need for a place to park school buses; the entrances and exits needed in case of fire; the amount of corridor and staircase space required to enable students to move quickly from one class to another; and the location, size, and equipment of the lunchroom, classrooms, laboratories, etc.

After studying all the requirements of a building, the architect draws up preliminary plans, which are submitted to the client for his approval. Any alterations the client may suggest are incorporated in the final design, which includes the ground and floor plans as well as drawings of the exterior of the building. The final design is then translated into working drawings, which show the exact dimensions of every part of the structure and where plumbing, heating, air-conditioning, and other equipment are to be placed. In preparing these working drawings, the architect must take into account local and State building laws and other regulations. When the working drawings are completed, consulting structural, mechanical, and heating engineers are called in (except on small jobs where engineers employed by the plumbing and heating contractors may provide the engineering services needed). The engineers' mechanical drawings are then coordinated with the architect's working drawings, and specifications are prepared listing

Architect submitting plans of new building for client's approval.

the materials to be used in construction, the equipment, and, in some cases, the furnishings to be installed.

The building is now "off the board," but the architect's responsibility is by no means over. He prepares a list of the building contractors to be invited to bid and receives their sealed bids. He assists the client in deciding which bid to accept and in drawing up the contract between client and contractor. The architect also acts as the client's advisor and represents him in dealings with the contractor. As construction proceeds, the architect makes periodic inspections of the project to make certain that the design is not altered and that the materials specified in the contract are used in the construction. If problems arise, he may act as arbitrator between client and contractor. Not until the project is finished, all the required tests made, and guarantees received from the many contractors, is the architect's work completed.

Most architects plan and design a wide variety of structures, ranging from schools and churches to hospitals and bus terminals. However, some architects confine their practice to the design of one particular class of structure, such as residential, industrial, or educational buildings.

In large architectural firms and when working on large-scale projects, architects frequently specialize in one phase of architectural work, usually design, administration, specification writing, or construction supervision. Most employees in large architectural firms, however, prepare working drawings of the various projects, the scope of their activity and the degree of their responsibility depending on their ability and experience.

Where Employed

There were about 24,000 registered (licensed) architects in the United States in 1957. In addition, about 5,000 people who had not received a license were working as architects. Although there are some outstanding women architects, only about 1 percent of the registered architects are women.

Approximately half of all architects are self-employed, either as individual architects or members of a firm of architects. Most of the others are employees of architectural firms. Some architects work for engineers, builders, real estate firms, and other businesses with large construction programs. A small number are employed by various government agencies. Another small group are full-time teachers in schools of architecture. A few architects are employed in fields related to architecture, such as contracting, sales engineering, and city planning.

Members of the profession are located in all parts of the country, mainly in metropolitan areas. In 1957, more than half of the registered architects were in the following seven States: New York, California, Illinois, Pennsylvania, Texas, Ohio, and New Jersey.

Training and Other Qualifications

A license for the practice of architecture is required by law in all States and Territories. In general, the purpose of these laws is to ensure that architectural work, which may affect life, health, or property is done by licensed architects. Requirements for admission to the licensing examination vary among States, but generally include graduation from a recognized professional school followed by 3 years of practical experience in an architect's office. As a substitute for architectural school training, however, most States accept longer periods of experience, usually 10 to 12 years.

Professional training in architecture was offered in 1958 by 65 colleges and universities in the United States and Canada, 50 of which were accredited by the National Architectural Accrediting Board. The great majority of these collegiate schools of architecture offer a 5-year curriculum leading to the bachelor of architecture degree.

Entrance requirements vary from one architectural school to another, generally conforming to the standards set for the liberal arts college with which the school or department of architecture is associated. Most schools of architecture admit qualified high school graduates, but some require 2 to 4 years of preprofessional education in a college or university. Practically all architectural schools, however, emphasize a knowledge of high school mathematics as a condition for entrance. Training or facility in both freehand drawing and drafting are important tools for an architect, though not a requirement for entering a course in architecture.

A typical curriculum in architecture includes general subjects—usually English, mathematics, physics, chemistry, sociology, and economics—as well as architectural subjects. Some examples of technical and professional courses included in an architectural curriculum are: Structural theory, mechanics and strength of materials, graphic presentation, history of architecture, architectural design, specification writing, working drawings, and professional practice and ethics.

Success in the profession requires an unusual combination of abilities—not only the capacity to master technical problems but also a gift for artistic creation and a flair for business and for human relations. It is often recommended that, to gage his interests and potentialities, a young person should, if possible, spend some time in an architect's office before entering architectural school. Architectural students are also encouraged to work in architects' offices or for building contractors during summer vacations. Summer work in an architect's office gives the student some knowledge of practical problems and an advantage over the inexperienced graduate when he looks for his first regular job.

After completing his academic training, the new graduate usually begins as a junior draftsman, assigned mainly to display drawings or to the drafting of details in the working drawings. As his proficiency increases, he is given added responsibility and is entrusted with more complex work. After about 3 years, he usually graduates to chief or senior draftsman, with responsibility for all the major details of a set of working drawings. If he continues to work for an architectural firm, he will probably progress to a job captaincy, with responsibility for a full set of working drawings and for the supervision of other draftsmen. A job captain may also draw up the preliminary plans for a structure. Some men who remain employees in architectural firms become designers rather than job captains or construction supervision; whereas, others branch off into specification writing. An employee who is particularly valued by his firm may be designated an associate, and may receive a share of the profits as well as his salary. However, the architect's usual goal is to set up his own practice. About half achieve this goal.

Employment Outlook

Employment opportunities for architects are expected to be favorable during the early 1960's; and the long run outlook is for continued growth of the profession.

Since most architects work on nonresidential projects—office buildings, stores, schools, hospitals, government buildings—the demand for architects' services depends primarily on the volume of such construction. Nonresidential construction, which reached record levels in the mid-1950's, is expected to increase considerably in the future. By 1965, the volume of nonresidential construction may be about 30 percent greater than in 1957, and by 1975, nearly 70 percent greater. Residential construction, which also utilizes some architects, is expected to more than double by 1975. Moreover, the increasing size and complexity of modern buildings, which usually require skilled architectural planning, and homeowners' new awareness of the value of architects' services are expected to bring about their greater utilization in construction. Thus, the demand for architectural services should expand substantially during the next decade. In addition to positions created by the expected increase in demand for architectural services, more than 600 openings are likely to arise each year owing to retirements and deaths.

Along with the anticipated growth of employment in the profession, a rise in the number of architectural graduates is likely to occur. Assuming that graduations in this field follow the trend expected in college graduations as a whole, the number of architectural degrees awarded each year during the 1960's should be considerably greater than the 1,500 degrees awarded in 1957. Nevertheless, if the construction industry expands as anticipated, new architectural graduates should have favorable employment opportunities through the early 1960's, at least. On the other hand, a long period of reduced construction activity—such as that which occurred during the 1930's—would undoubtedly affect adversely the employment opportunities for architects.

The outlook for women architects is much more uncertain than for men. In recent years, a woman who was a good draftsman could readily obtain employment, and this situation is expected to continue. However, chances of advancement are limited for most women architects, and few women achieve an associateship or establish themselves in private practice.

Earnings and Working Conditions

Starting salaries for architectural school graduates with some experience ranged from $80 to $100 a week in 1958, according to available information. Draftsmen with 3 or more years' experience had salaries ranging up to $150 a week; job captains, specification writers, and other senior employees earned up to $200 a week.

Architects in private practice generally earn considerably more than high-paid salaried employees of architectural firms. However, the range of incomes is very wide. For example, some architects with many years of experience and good reputations earn well in excess of $25,000 a year, while many architects not long in private practice have very low incomes. Young architects who start their own offices often go through a period when their expenses are greater than their income. The need for a financial reserve in the initial period of practice and the wide range of earnings are characteristics of all self-employed professional groups.

Where To Go for More Information

American Institute of Architects,
1735 New York Ave. NW., Washington 6, D.C.

Commercial Artists

(D.O.T. 0–44.)

Nature of Work

Many of the eye-catching illustrations in advertisements, books, magazines, posters, displays, and television commercials are designed and drawn by commercial artists. These artists may also retouch photographic prints, prepare charts and maps, draw movie cartoons, do freehand and mechanical lettering, design labels for containers, and sketch and color designs for greeting cards. In contrast with painters and others engaged in the fine arts who have a free choice of subject matter and technique, the commercial artist does work to fit the requirements of a specific client or employer. Of the approximately 80,000 artists and art teachers employed in 1950, it is estimated that the majority were commercial artists.

Commercial art work requires skills ranging from highly creative planning, designing, and drawing to relatively routine mechanical operations. Many artists specialize in a particular technique or type of commercial art. Among the most important specialists are layout men who choose and arrange the positions of pictures and lettering so as to attract the eye; illustrators who are primarily concerned with making the sketches and drawings; and letterers who design and execute the appropriate lettering, either freehand or with the use of mechanical aids.

Where Employed

The largest employers of commercial artists are advertising agencies, commercial art studios, printing and publishing companies, television and motion picture studios, and department stores. A number work for Federal Government agencies, principally the Departments of the Army, Navy, and Air Force. Others are in sign shops, mail-order houses, calendar and greeting card companies, and a variety of other business establishments. A few commercial artists teach in art schools. Many are free-lance artists who do work on a fee basis for various clients. Some commercial artists who hold salaried positions also do free-lance work.

Most commercial artists are employed in big cities, such as New York, Chicago, Philadelphia, Los Angeles, and Detroit where the largest users of commercial art are located.

Training and Other Qualifications

Artistic ability is the most important qualification needed to become a commercial artist. In addition, a considerable amount of training in the techniques of commercial art is required. This may be obtained in art schools, in commercial art courses offered by public vocational high schools, and through practical experience on the job. Training exclusively in the fine arts—painting, sculpture, or architecture—is not generally considered appropriate preparation for employment as a commercial artist.

The most widely accepted training for commercial artists is that given in art schools or institutes which specialize in teaching commercial and applied art. To enter art school, a high school education is usually, but not always, required. Some schools admit only those applicants who demonstrate talent by submitting acceptable work samples. The course of study generally takes 2 or 3 years and a certificate is awarded on graduation. A growing number of art schools, particularly those connected with universities, require 4 years of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.) degree. In these schools, commercial art instruction is supplemented by cultural subjects such as English and history.

The first year in art school may be devoted to the study of such fundamentals as perspective, design, color harmony, composition, and use of crayon, pencil, pen and ink, and other artistic mediums. Subsequent study generally includes drawing from life, advertising layout, lettering, typography, illustration, and highly specialized courses in the student's particular field of interest.

Good drawing technique, creative imagination, and artistic judgment concerning the harmony of color and line are basic requirements for a successful career in commercial art. The various specialties, however, differ in some of the specific abilities required. For example, letterers and retouchers must be able to do precise and detailed work requiring excellent coordination, whereas the qualifications most needed by illustrators are that they be highly imaginative and able to draw well. For commercial artists engaged in free-lance work, the ability to sell both ideas and finished work to employers or clients is very important.

Commercial artist preparing copy for newspaper advertisement.

Beginning commercial artists usually need some on-the-job training before they can qualify for other than strictly routine jobs. Beginners are generally assigned to work such as erasing smudges from art work, filling in colors on experienced artists' drawings, and doing pasteup work (using scissors and a pot of paste to assemble the components of an advertisement or other art work). Advancement is based largely on the individual's artistic talent and creative ability as demonstrated on the job. Those with the necessary qualities can become layout men, letterers, illustrators, or other specialists. After a few years of experience, some commercial artists leave salaried employment for free-lance work.

Employment Outlook

Employment and advancement opportunities for talented and well-trained commercial artists are expected to be good in the early 1960's. However, persons with only average ability will have difficulty entering the field and, if hired, will find limited chances for advancement. As in past years, the demand will be greater for commercial artists with specialized skills—for example, in lettering, layout, pasteup and typography—than for those with only general training. However, beginners seeking work as illustrators may find limited employment opportunities, if employers continue to show a strong preference for the services of experienced free-lance artists.

A gradual increase in employment of commercial artists is expected over the long run. The upward trend in business expenditures for all kinds of visual advertising will be reflected in a growing demand for commercial artists; the television industry and packaging design are expected to offer expanding areas of employment; and other forms of art such as poster and window displays, greeting cards, calendars, and movie cartoons will also probably employ an increasing number of artists. In addition, the growing field of industrial design is expected to need more artists who are qualified to work with engineering concepts. Although the greater use of photography may continue to displace illustrators in a few types of work, a growing demand for their services is expected in television and other fields. Generally, the effect of a serious economic downturn would be a reduction in advertising budgets and a decrease in employment of commercial artists; however, during minor business recessions the policy of many companies is to push their products more vigorously through the use of advertising art.

Women with exceptional artistic talent will continue to find employment in all aspects of commercial art work. Work as fashion illustrators in department stores is the major source of employment open to women artists. However, some do free-lance work, and others hold positions with printing and publishing houses, greeting card companies, advertising agencies, commercial art studios, and government agencies.

Earnings and Working Conditions

Inexperienced commercial artists earned, on the average, between $50 and $70 a week in 1958, although some started at higher salaries. The amount earned varies with the beginner's talent as revealed by his portfolio of samples, his training, the particular job, the type of firm, and geographic location. After a few years of experience, qualified artists may expect to earn $100 or more a week. Art directors, designers, executives, well-known free-lance illustrators, and others in top positions generally have much higher earnings.

A 1955 survey (made by Art Direction magazine) of 2,500 art directors and other commercial artists in top positions showed that about 75 percent earned between $5,000 and $15,000 annually. More than 20 percent made $15,000 or more annually, and fewer than 5 percent earned less than $5,000 a year. Earnings were higher in New York City than in any of the other 20 cities included in the survey; the median (average) salary was between $15,000 and $20,000 yearly in New York. In Chicago, Cleveland, Detroit, Los Angeles, Miami, Minneapolis, and Philadelphia, the median salaries were between $10,000 and $15,000 annually. Nearly one out of every three salaried persons surveyed also did free-lance work.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes must work long hours under a considerable amount of pressure in order to meet deadlines. Free-lance artists usually have irregular working hours.

Where To Go for More Information

Information on art training and employment trends is available from:

National Society of Art Directors,
115 East 40th St., New York 16, N.Y.

A list of schools offering highly specialized education in art and design is available from:

National Association of Schools of Design,
50 Astor Place, New York 3, N.Y.

Foresters

(D.O.T. 0–35.07)

Nature of Work

Forests are one of America's greatest natural resources, covering more than one-fourth of the land area of the country. Foresters protect, manage, and develop these valuable properties. Safeguarding forests from fire, destructive insects, and diseases is one part of their work. Other important duties include reforestation, estimating the amount of timber in a forest area and appraising its value, selling or buying timber, and planning and supervising the cutting of timber so that mature trees are removed and younger ones left for future logging operations. In addition, the *forest-land manager* is often responsible for all other resources and activities in his area, including camps and parks, wildlife, and grazing land.

Because the work of the forester covers such a wide range of activities, numerous specialties have developed. Included among these are wildlife management, range management, forest economics, and recreation work. Foresters may also specialize in such activities as research, writing and editing, and extension work (providing information concerning scientific forestry practice to farmers, logging companies, and the public), and teaching at the university level. Some of the specialties are rapidly becoming recognized as distinct professions. For example, *wood technologists* study the physical and chemical properties of wood, develop new uses for wood, and bring about better utilization of wood and its byproducts.

Where Employed

Approximately 17,000 professional foresters were employed in forestry and closely allied fields in 1958, according to estimates made by the Society of American Foresters. About 7,500 of these were in private industry, working mainly for lumber, pulp and paper, and veneer and plywood companies, though some were in business for themselves as consultants or managers of their own land. Although there are only a few hundred forest consultants, this field represents a growing source of employment for professional foresters.

Nearly as many foresters were in government as in private employment. In 1958, about 5,000 worked for the Federal Government, mainly in the Forest Service of the U.S. Department of Agriculture. In addition, about 1,800 worked for State Governments and about 250 for county and municipal governments.

College teaching and other educational activities, including extension work and university research, provided employment for approximately 750 foresters. The remaining 1,800 held a variety of jobs. This group included specialists in such closely allied fields as wildlife, range management, tree culture, forest engineering, and watershed management.

Training and Other Qualifications

Four years of college work leading to a bachelor's degree in forestry is usually the minimum educational requirement for entrance into the profession. Most schools require that students spend one summer in summer camps operated by their college. Forestry students are also encouraged to work other summers in order to gain first-hand experience in forest or conservation work.

COURTESY OF U.S. FOREST SERVICE

Forester checking the growth of a red pine with an increment borer.

Training in forestry leading to a bachelor's or higher degree was offered in 1958 by 40 schools, 27 of which were accredited by the Society of American Foresters. In addition to courses in science, engineering, economics, and the humanities, the curriculums in most of these schools include specialized forestry courses in five essential areas: (1) silviculture (methods of growing and improving forest crops); (2) forest protection (from fire, insects, and disease); (3) forest management (the application of business methods and technical forestry principles to the operation of a forest property); (4) forest economics (study of the factors affecting the supply of and the demand for forest products); and (5) forest utilization (the harvesting and marketing of timber and other forest resources).

Most schools offer an additional year of training leading to the master's degree and some offer doctoral training. Although graduate training is not essential for entrance into the profession, the master's degree is generally required for teaching or research positions and the doctorate is highly desirable for such posts.

Some foresters have entered the profession with training primarily in a related field such as horticulture, botany, agronomy, or other biological sciences. Also, specialists in forest engineering have entered with engineering degrees, and forest product technologists and specialists in the utilization of wood and wood products have entered the field with degrees in chemistry, physics, or engineering. However, the attainment of professional status without a degree in forestry is becoming more and more difficult.

In addition to adequate training, qualifications for success in forestry include the ability to meet and deal effectively with people. Many jobs also require the ability to endure vigorous physical activity, and a willingness to work occasionally in isolated areas.

Employment Outlook

Employment opportunities for forestry graduates are expected to be favorable during the early 1960's. As in recent years, there will probably be particular need for well qualified personnel with advanced degrees for research and teaching positions.

The demand for foresters has risen rapidly since the end of World War II, principally as a result of large-scale application of scientific management to forest lands owned by private industry. Employment of foresters in State and Federal Governments has also increased steadily during the past decade. Moreover, the growth of fields closely allied to forestry—such as wildlife management, wood utilization, watershed management, forest recreation, and range management—has provided many new positions, in both government and private industry.

The long-run outlook is for continued expansion of employment in forestry. The country's growing population and rising living standards will tend to increase the demand for lumber, paper, and other major forest products, although the demand for these products will also be influenced by any changes in the general level of business activity affecting construction and other major wood using industries. Recent trends emphasizing scientific forestry practice are also expected to continue. If, during the next two decades the demand for timber should rise much more than anticipated, scientific forestry practice would undoubtedly be extended and intensified, thereby increasing the demand for foresters.

Private and industrial owners of timberland are expected to continue to offer numerous employment opportunities for foresters during the next decade, primarily because of the expected increase in the demand for wood and wood products. The industry is becoming increasingly aware of the profitability of improved forestry and logging practices and is making use of new technical developments for utilizing the entire forest crop. Technical developments are also expected to make it possible to cut timber in forests now regarded as unprofitable for timber operations. Furthermore, competition from metal, plastics, and other products is expected to stimulate research and development in wood utilization and technology to reduce costs and develop new and improved products.

Employment of foresters in the Federal Government is also expected to grow in the next decade. In early 1958, the Forest Service of the U.S. Department of Agriculture anticipated that its employment of foresters would grow at an even more rapid rate in the future than in the past. Among the major factors which are expected to bring about this growth are the increasing volume of timber cut on Federal lands, and the trend toward more scientific management of these lands. Of course, funds necessary for the intensification of scientific management of Federal lands are subject to congressional approval.

State Government agencies also will probably continue to expand their employment of foresters. Forest fire control and other Federal-State cooperative programs, such as providing technical advice to owners of private forest lands, are being channeled more and more through State organizations. Growing demands for recreation facilities in forest lands are likely to result in expansion of State parks and other recreation areas.

In addition to openings created by the growing need for professional foresters, some vacancies will occur as a result of retirements and deaths. However, such openings will not be numerous during the 1960's, since foresters are a relatively young group.

Along with the anticipated growth of employment in the profession, a rise in the number of forestry graduates is likely to occur. If young men with degrees in forestry continue to represent the same proportion of all college graduates as in recent years, the number of bachelor's degrees granted each year in forestry will, by the late 1960's, be almost twice the 1957 figure and, by 1970, will be about as high as in the peak year 1950. Graduating classes of this size may encounter competition for the better paying professional entry jobs in forestry, unless scientific management of forests expands faster than is indicated by present trends.

Opportunities for women in the profession of forestry are and probably will continue to be limited, largely because of the necessary field work, much of which is rigorous and in isolated places. The few women presently employed in forestry are engaged chiefly in research, and future opportunities for women are also likely to be primarily in this field.

Earnings and Working Conditions

Starting salaries for new forestry graduates with bachelor's degrees were usually between $3,880 and $4,500 in private industry in 1958, according to the Society of American Foresters. In more responsible jobs, such as managing a company forest, salaries were typically $7,500 to $9,000. Foresters holding executive positions in land management or wood procurement were reported to earn from $10,000 to $15,000, and those who were officers of corporations usually received from $15,000 upward. In addition to their salaries, foresters in private industry may be furnished nonmonetary benefits such as rent-free houses, fuel, and the use of company transportation.

In the Federal Government in 1958, the beginning salary of foresters with only the bachelor's degree was either $4,340 or $4,980 a year, depending on their college record. Those with 1 full year of graduate study could begin at $4,980; those with 2 full years at $5,985. New graduates with a doctor's degree were eligible to start at $7,030 if employed in research work. In addition, the salary schedule provides for periodic increases above these base salaries. Some individuals in administrative and supervisory positions received higher salaries. For example, in the U.S. Forest Service, forest rangers in charge of a district earned from $5,985 to $8,230, annually. Supervisors of national forests received from $8,330 to $11,090, and regional foresters, who administer a number of national forests as well as engage in cooperative activities with States and private landowners, received from $12,770 to $13,970 a year. When living quarters are furnished, a salary deduction is made. The amount varies with the value and kind of accommodations but was usually from $200 to $600 per year in 1958.

Salaries for foresters employed by the States have been generally somewhat lower than those paid by the Federal Government. In recent years, however, salaries paid by many State governments, particularly those paid beginning foresters, have increased so that they are now close to salaries in the Federal Government.

Salaries in teaching and research in a college or university depend upon the institution and the position held. In the 27 schools of forestry accredited by the Society of American Foresters, 1958 salaries averaged about $4,000 for beginning instructors and ranged from $6,000 to $12,000 for professors. Heads of departments or schools earned between $7,500 and $15,000 a year.

As part of his regular duties, the forester must spend considerable time out of doors under all kinds of weather conditions. Many foresters put in extra hours in travel and in emergency duty such as firefighting. Travel often involves absence from home for extended periods of time, particularly in beginning jobs. The young forester is also likely to have his headquarters shifted frequently. With advancement to more responsible positions, he can expect a more permanent assignment.

The hazardous nature of many forestry jobs is indicated by the fact that insurance companies often require extra premiums for forest rangers and others whose duties involve working alone in remote areas. Foresters working in logging and sawmilling may also face accident hazards. Although injury rates in these industries have been reduced, they are still far above the average for manufacturing industries.

Where To Go for More Information

Additional information on the profession of forestry may be obtained from:

Society of American Foresters,
825 Mills Bldg., 17th and Pennsylvania Ave. NW.
Washington 6, D.C.

Forest Service, U.S. Department of Agriculture,
Washington 25, D.C.

American Forest Products Industries, Inc.,
1816 N St. NW., Washington 6, D.C.

Additional information on schools providing instruction in forestry may be obtained from the first two organizations mentioned above.

The U.S. Civil Service Commission, Washington 25, D.C., will furnish information on positions available in Federal Government agencies. (For further information on such positions and how to apply for them, see chapter on Government Occupations.)

Home Economists*

(D.O.T. 0–12.10 through .36)

Nature of Work and Where Employed

Persons trained in home economics are employed in a variety of occupations. They may teach home economics, become dietitians or extension service workers, or serve as home economists in business or in research. In addition to their similar basic training, these occupational groups have a common interest in improving home products, services, and activities. Many specialize in either foods, clothing and textiles, home equipment, or household management. Those who do not specialize include some teachers, demonstrators, or counselors—whose work often requires a broad knowledge of many homemaking activities. In performing their work, home economists draw upon pertinent knowledge and skills for many other fields as, for example, education, chemistry, physics, art, economics, psychology, and journalism.

Approximately 80,000 persons who have received home economics training were employed in home economist occupations in 1958. The largest group, about 44,000, were home economics teachers. Of these, approximately 27,000 were employed in public secondary schools, about 500 in private and parochial schools, about 3,000 in colleges and universities, and about 13,000 in adult education programs. (For information on teaching, see statements on Secondary School Teachers and on College and University Teachers in this Handbook. See index for page numbers.) About 250 home economists specializing in child development or family relations were employed as teachers in nursery schools, kindergartens, recreation centers, or children's institutions.

Others who have been trained in home economics and were employed in 1958 included about 25,000 dietitians (see statement on dietitians), a small number of nutritionists (engaged primarily in the study and promotion of good nutrition practices), and about 5,000 extension service workers. (See statement on Agricultural Extension Service Workers.)

Home Economists in Business. Of the remaining number in home economist occupations, probably between 5,000 and 6,000 were specialists employed by private business firms and associations to help promote the development, use, and care

*Prepared by the Women's Bureau, U.S. Department of Labor.

Home economist conducting a food-tasting panel to test new recipes.

of specific home products. Home economists in this group work not only for commercial establishments which manufacture or distribute products or provide services in the home but also for magazines, newspapers, radio, and television.

The largest group of home economists in business, possibly over 2,000 in 1958, were employed by food manufacturers to study consumer needs, to help manufacturers translate these needs into desirable products, and to provide miscellaneous consumer services. An important part of their work is done in test kitchens—developing new recipes, improving present products, or helping to create new products. They usually write directions for food packages; prepare booklets, leaflets, or cookbooks; and answer customers' inquiries. Sometimes, they also give food demonstrations or lectures and prepare materials for television programs or film strips.

Another large group, perhaps almost 2,000, were home-service workers employed by gas or electric utility companies. They visit customers' homes on request or to demonstrate the operation of newly installed equipment, such as that used in cooking, heating, refrigeration, or clothes drying. In private visits or in talks before clubwomen, youth groups, or retailers, these home economists often give advice on kitchen planning and laundry problems, in addition to describing the operation and benefits of their company's products. To promote further public understanding, they may also answer inquiries, write newspaper articles or pamphlets, broadcast company-sponsored programs on radio or television, or conduct classes for salesmen and servicemen.

About 400 home economists, known as equipment workers, worked for manufacturers of such household equipment as ranges, refrigerators, kitchen utensils, and laundry equipment. One of their major duties is to prepare or supervise the preparation of instructional material relating to the use and care of the manufacturer's products. They work with engineers on product development and also devise plans for product uses. Equipment workers spend a good deal of time training others—especially home-service workers, salesmen, and servicemen—concerning the characteristics of products. To do this, they sometimes travel out of town to confer with dealers and distributors. Their work may also include preparing press releases and radio and TV programs.

About 400 more home economists worked exclusively in journalism, radio, and television. Gathering information from a variety of sources, they interpret trends and prepare useful, timely, and interesting stories on food, clothing, or other topics of interest to homemakers. They may test products themselves or evaluate the tests of others. Some regularly write food, diet, or homemaking columns and others edit the home economics section of a newspaper or magazine. Those employed by radio and television stations may personally conduct their own programs or act as consultants for others. Home economists who specialize in foods may also conduct cooking courses.

Possibly 250 other specialists were engaged in advertising and public relations work, serving on the staff of agencies in these fields or with companies producing or distributing all types of homefurnishings, household supplies, and services. They may secure background material for advertising campaigns, test consumer products in research laboratories or test kitchens, prepare newspaper articles and photographic displays, give homemaking courses, or make speeches.

In the field of textiles and clothing, about 100 home economists held a variety of positions with dress-pattern companies, textile and clothing manufacturers, laundry and dry-cleaning establishments, and a few chain clothing stores. They may conduct consumer surveys or laboratory tests and report on the functional and economical characteristics of fabrics and fibers used in clothing and household furnishings. They may work as fashion coordinators, personal shoppers, or fashion designers. Those specializing in interior decoration arrange displays for business establishments or give advice on home decoration. Some enter the retail clothing field and work up to positions as buyers or other executives. (See section on Department Store Occupations.)

Home Economists in Research. A small number of home economists perform research work in laboratories and offices of the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The largest single group in home economics research, about 100, work for the Institute of Home Economics of the U.S. Department of Agriculture. Engaged in research on food and nutrition, textiles and clothing, housing, household equipment, or household economics, these home economists utilize skills of a variety of fields, including chemistry, physics, biology, statistics, economics, and psychology. For example, some make farm family surveys to determine the amounts that farm families spend for such items as food, clothing, housefurnishings, and medical care. From these findings, they develop budget guides needed by home economists in teaching, family counseling, social welfare, and extension work. Other home economists perform laboratory tests to determine the effect of different household methods of cooking on flavor, tenderness, or yield of a food.

Other Related Fields of Work. About 300 home economists were employed on social welfare programs by State, county, city, and private welfare agencies. They act chiefly as advisers and consultants in the development of budget standards for needy families, helping to determine the amount of financial assistance needed to provide minimum healthful living standards.

Training in home economics is useful in a number of other fields. Some home economists specialize in housing, advising architectural firms on home planning, equipment arrangements, and the selection of household appliances. A few are employed in such industries as finance, giving customers advice on spending and saving; moving, studying household moving problems; and food chains, providing food and household information to consumers. A fairly new field for home economists is rehabilitation, in which they work as homemaking counselors and consultants, helping handicapped homemakers and their families adjust to the homemaker's handicap by changing physical arrangements in the home and revising methods of work. Some experienced home economists are also employed abroad by the Federal Government, foundations, international organizations, and American businesses with foreign subsidiaries—primarily to work as teachers or consultants on programs aimed at promoting good practices in homemaking and contributing to higher living and educational standards.

Although home economics is generally considered a woman's field, a growing number of men are entering various home economics positions. Some men are engaged in teaching, merchandising, interior designing, and family counseling, but most of them specialize in foods and institution management.

Training and Other Qualifications

Four years of college study leading to a bachelor's degree in home economics is the minimum requirement for professional work in home economics. Some types of work, such as that of the nutritionist, of the college teacher, and certain kinds of research and supervision, require a master's or a doctor's degree.

About 500 colleges and universities in the country offer home economics training and grant degrees with majors in home economics. In addition to such liberal arts courses as English, psychology, economics, physiology, and chemistry, the basic courses for home economics undergraduates generally contain an introduction to all phases of home economics. The curriculum usually includes courses on foods and nutrition, clothing and textiles, home management, and household equipment as well as courses on art and design, family relations, and child development. Undergraduates are advised to elect additional courses in the field of their special interest. For those wishing to specialize in foods, advanced courses in chemistry and nutrition are valuable, as are science and statistics courses for research work and journalism courses for advertising and public relations work. In order to teach home economics, it is necessary to take the education courses required for a teacher's certificate.

During the school year 1957–58, 7,883 bachelor's degrees, 805 master's degrees, and 37 doctorates were earned in home economics or home economics education. More than 6 percent of all the baccalaureate degrees granted to women that year were in these two subjects.

Financial assistance available to home economics undergraduates is much the same as that for all undergraduate students in the country, although some scholarships are open only to students of home economics. Significant numbers of scholarships, fellowships, and assistantships, however, are specified for home economics students engaged in graduate work. An American Home Economics Association (AHEA) study of financial grants available for home economics graduates during the school years 1958–59 and 1959–60 listed 531 assistantships, 47 fellowships, and 27 scholarships. The typical assistantship approximated $1,500 to $1,800 and required 20 hours of service a week during the school year. The typical fellowship ranged between $1,000 and $1,600 a year. These grants are provided mainly by colleges and universities but also by government agencies, research foundations, industry, and the AHEA itself.

Besides adequate training, personal qualifications needed by home economists include a strong interest in the welfare of people and in homemaking activities. Home economists must be able to work with people of various standards and backgrounds and should have a capacity for leadership with ability to inspire cooperation. Good grooming, poise, and a pleasant manner are needed, particularly by those dealing with the public, since they reflect the standards of the profession.

Opportunities for home economists to advance exist not only in supervisory and administrative work but also in research and other special fields. Positions also vary with the size of the employing establishment. In organizations with numerous home economists, each employee is usually assigned a specific type of work under a department head or director. In many organizations, however, there is usually just one home economist with broad responsibility for a variety of assignments.

Employment Outlook

The demand for home economists in education, research, and business remains high and is expected to continue well into the 1960's. Job turnover caused by marriage and family responsibilities is particularly heavy among these workers, many of whom studied home economics as preparation for homemaking. In addition to replacement needs, there is a growing demand for home economics services in many areas of employment—both old and new.

In the field of education, the shortage of home economics teachers is especially critical in public secondary schools. More teachers are needed because of the rising enrollments in secondary schools throughout the country, the addition of home economics study in district schools consolidated from local schools previously without a home economics department, and the expansion of these departments in other schools. Moreover, it has been estimated that as many as 5,000 home economics teachers must be recruited annually as replacements. Home economists with graduate degrees are in considerable demand as college teachers and as administrators, not only in education but in other fields as well.

The need for more home economists in research is expected to increase with the continued interest in using scientific methods for improving various home products and services. Similarly, in many business establishments, employers are becoming increasingly aware of the contributions of professionally trained home economists and are hiring an expanding number of home economics majors.

Shortages of home economists are most acute at two levels: In administrative positions (where advanced education and experience are essential) and in entrance positions. Not enough home economics graduates are entering and remaining in home economist occupations to satisfy current demand. For example, a 1955 study by the U.S. Office of Education indicated that about one-

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third of the home economics graduates who were prepared to teach did not, in fact, become classroom teachers.

Thus, the continuing population growth, the increasing demand for the services of home economists in many fields, and the insufficient numbers of graduates in home economics—all point to good employment opportunities for persons trained as home economists.

Earnings and Working Conditions

Starting salaries of women who were graduated from college in June 1957 and secured jobs as home economists averaged $4,040 in the winter of 1957–58. Their average earnings were exceeded only by the chemists ($4,847) and the mathematicians and statisticians ($4,675) among the recent women graduates covered by a joint survey of the National Vocational Guidance Association and the U.S. Department of Labor's Women's Bureau.

In urban areas with 30,000 and over population, the average (median) salary of beginning teachers with a bachelor's degree was $4,000 for the school year 1958–59, according to a National Education Association survey. Home economics teachers generally receive the same salaries as other teachers, as most school districts have a single-salary schedule based on education and experience for all teachers in their area. The NEA also reported that the average (mean) salary of all secondary school teachers (including both beginning and experienced teachers) was $5,110 in 1958–59.

Home economists in business usually received between $3,500 and $4,200 for beginning jobs in 1958. Chances for advancement and for higher earnings are good as experience and competency increase.

In the Federal Government, the entrance salary for inexperienced workers with baccalaureate degrees in home economics was $4,040 in 1958. For those with additional education and experience, salaries ranged from $4,980 to $11,090 a year, depending upon the type of position and level of responsibility involved.

Hours of work are irregular for some home economists as, for example, those engaged in promotional and advertising work who are expected to be available for evening demonstrations or other night work. On the other hand, research workers and others employed in business and manufacturing establishments usually work a regular 40-hour week or less. Most home economists are granted a paid vacation, sick leave, retirement pay, and insurance benefits.

Where To Go for More Information

Additional information about home economists, including names of schools offering home economics training and available scholarships, may be obtained from:

American Home Economics Association,
1600 20th St. NW., Washington 6, D.C.

Interior Designers and Decorators

(D.O.T. 0–43.40)

Nature of Work

Although artists have for centuries been employed to beautify palaces and public buildings, the occupation of the interior designer and decorator is only about 50 years old. The chief work of interior designers and decorators is to plan and supervise the furnishing of private homes and other structures, including offices, hotels, restaurants, stores, and ships. They also work on theater, motion picture, and television set decorations.

On most decorating jobs, the structure is determined before the decorator arrives on the scene—that is, the walls, doors, windows, heating equipment, and the like are in place. The decorator then selects and arranges the furniture, draperies, wall and floor coverings, lighting fixtures, lamps, and other decorative accessories, and may himself design certain items. On some jobs, he may also work with the architect in planning the interior of a new building or in remodeling an old one. This work is known as interior design.

The first step in a decorating job is usually to devise a color scheme and prepare a plan showing the placement of the furniture, accessories,

Interior decorator helping a customer select material for furniture covering.

and floor and wall coverings. The decorator may also—and for larger assignments usually does—make drawings or water colors of the finished interior, to illustrate his scheme. As a rule, he must furnish complete cost estimates for the client's approval. The second step is to assemble the furnishings. A good deal of the decorator's time goes into selecting the furniture, textiles, rugs, and decorative accessories and into supervising the painters, upholsterers, and other craftsmen who work on the interior and the furnishings. His job is not finished until everything is in place and ready for use.

Where Employed

More than 10,000 interior decorators, many of whom were women, were estimated to be employed in 1958. In addition, there were undoubtedly many other people, some of them part-time workers, who considered themselves interior decorators but who had little training in the field.

Many decorators have their own establishments. Some are "consulting decorators," who have no stock of furniture or fabrics to sell. More often, however, decorating establishments have furniture, decorative accessories, and fabrics for sale, since they find these attract clients for their services. Many of these establishments are operated by a single decorator with 1 assistant; others have a staff as large as 15 or more—some of whom are salespeople.

In recent years, large retail stores have become increasingly important as a source of employment for decorators. Many of the larger department and furniture stores have decorating departments. One of the main functions of such departments is to help in the store's sale of merchandise, though the decorators are rarely restricted to the store's stock in their plans for interiors. Department store decorators may also act as "homefurnishings coordinators," who advise the merchandising division and buyers concerning style and color trends in homefurnishings; this function is expected to become increasingly important. In addition, small numbers of interior designers and decorators are employed by architects, antique dealers, industrial designers, periodicals which feature articles on homefurnishings, and manufacturers in this field.

Since the business requires being near centers of population, the majority of decorators are located in large cities and their suburbs.

Training and Other Qualifications

Some of the successful interior decorators have "grown up" with this comparatively new field of work, and it is still possible to become a decorator with little or no formal training. An untrained person or one with very little training is at a distinct disadvantage in trying to enter the field, however, since most reputable decorating firms or department stores will accept only well-trained people in beginning jobs. For many jobs, the minimum formal education required is completion of a 3-year course at a recognized art school, or a 4-year college course leading to a Bachelor of Fine Arts degree, with a major in interior design and decoration.

The success of an interior decorator will depend, in good measure, on his ability to sell. The decorator who has his own establishment needs business ability, as well as good salesmanship and a pleasing personality. In addition, the high school student who plans to become an interior decorator should also have some aptitude for drawing and an interest in design.

The course of study in interior decorating usually includes the principles and history of art, free hand and mechanical drawing, painting, and study of the various materials, such as woods and fabrics, with which the decorator works. In addition, business courses such as salesmanship and business arithmetic are of great value.

The inexperienced art school or other graduate is not accepted as a qualified decorator, but is expected to serve an informal apprenticeship in the field, either with a decorating firm or in a department store. The apprentice may act as a receptionist, as a shopper with the task of matching materials or finding accessories, as a stockroom assistant, or as an assistant draftsman. Not all new graduates obtain these informal apprenticeships, since there are usually fewer openings than graduates. Those who fail to obtain these jobs are advised to work as salespeople in fabric, lamp, or other homefurnishings establishments or departments, to gain experience in dealing with customers. Such experience will make it easier to obtain an apprenticeship with a decorating firm or department. It may also ultimately lead to a career in merchandising or a career as a buyer.

The length of the on-the-job training period varies, depending on the individual's performance and the establishment's requirements. In many cases, the apprentice progresses from simple to more complex assignments without a change of title. In other cases, the young worker may be promoted to "assistant decorator" and given full responsibility for a small assignment, such as a single room. In any case, it is likely to take at least from 1 to 3 years before one advances to the position of decorator. Further advancement to supervisory positions or to head of a decorating department in a store usually depends on individual ability. The experienced decorator may also open his own decorating establishment, or may develop into a stylist or homefurnishings coordinator.

Employment Outlook

The demand for the services of interior designers and decorators is expected to continue to increase during the 1960's. The trend toward greater use of decorating services is rising, owing to the increasing availability of these services to customers at a moderate cost, and to a growing awareness of the decorator's role in contributing to the comfort and beauty of a home or other interior. Although growth in employment is expected, new entrants will still find it difficult to gain a foothold in this highly competitive field.

One reason for this is the ease of admission to decorating work due to the lack of established and accepted standards. Anyone who wishes to call himself a decorator can do so; and many women, having furnished their homes to their own and their friends' satisfaction, start a small decorating business. Consumers often find it difficult to evaluate the services offered by decorators, and will sometimes choose the amateur whose services may appear less expensive.

In recent years, department and furniture stores have played an increasingly important role in interior decoration for the home. At the same time, the growing volume of decorating work in commercial establishments and public buildings has most often been placed with the larger decorating establishments. It is expected that the larger establishments, both stores and decorating firms, will gain an increasing share of the expanding decorating business. This development will make for greater orderliness in the trade and provide increased opportunities for regular employment. On the other hand, the use of interior designing and decorating services has fluctuated in the past depending on general economic conditions, and income and employment in the occupation would undoubtedly again reflect any sharp decline in the general level of business activity.

Earnings

Beginning salaries for graduates of schools giving diplomas in interior design and decoration, or of colleges offering majors in this field, were typically between $50 and $65 a week in 1958, according to limited data available for some eastern cities. Assistant and full-fledged decorators may be paid either a straight salary, a salary plus commission or bonus, or a straight commission. The earnings of most department store decorators are usually figured directly as a percentage of their sales. Decorating establishments may also offer their employees a proportion of the profits, particularly when an employee has made the original contact with a customer.

Many decorating firms and department stores, do not charge a fee for their services, but derive their income from profit made on furnishings sold to customers. Some decorators charge a fee for advice on a prospective job if they are not given the final contract.

The fact that earnings are so closely geared to sales means that, for both employees and independent decorators, the income range is very wide. Some interior designers and decorators earn only a moderate income, whereas others make $20,000 or more a year.

Where To Go for More Information

American Institute of Decorators,
673 Fifth Ave., New York 22, N.Y.

Lawyers

(D.O.T. 0–22.)

Nature of Work

Most businesses require the services of a lawyer to take care of many different kinds of legal problems—for example, in resolving tax matters, arranging for new issues of stock or other securities, buying and selling property, and handling claims made against the companies. Many individuals also need the advice of a lawyer from time to time, in buying a house, drawing up a will, or in other circumstances.

Lawyers (attorneys) advise clients on their legal rights and obligations and, when necessary, represent them in courts of law. In addition, they negotiate settlements out of court and represent clients before quasi-judicial or administrative agencies of the government. They may also act as trustees, guardians, or executors. Government attorneys play a large part in administering Federal and State laws and programs; they prepare drafts of proposed legislation, establish procedures for law enforcement, and argue cases in the courts. Some lawyers serve as judges in Federal, State, and local courts. Others are primarily engaged in teaching, research, writing, or administrative activities.

The great majority of lawyers are in general practice, handling all kinds of legal work for clients. However, an increasing number are specializing in some branch of the law such as administrative, admiralty, corporation, criminal, estates and wills, international, labor, patent, real estate, trust, and tax law. Some attorneys devote themselves entirely to trying cases in the courts. Others never appear in court and limit their work to such activities as drawing up legal documents, conducting out-of-court negotiations, or doing the legal work necessary to prepare for trials.

Many persons with legal training are not employed as lawyers but are in other occupations which require some knowledge of law. They may, for example, be FBI agents, insurance adjusters, tax collectors, probation officers, credit investigators, or claim examiners.

Where Employed

Nearly 80 percent of the 226,000 lawyers listed by the American Bar Association as professionally active in 1958 were in private practice. Approximately two-thirds of the private practitioners were in practice by themselves; more than one-fourth were in a partnership; and the remainder—only about 6 percent—worked for other lawyers or law firms.

The greatest number of salaried attorneys are employed by government agencies. In 1958, the Federal Government employed approximately 12,000 attorneys, chiefly in the Department of Justice, the Department of Defense, and the Veterans Administration. About 8,000 attorneys held positions with municipal governments, and 4,000 were employed by State governments. Nearly 8,000 held judicial positions. More than a thousand were military personnel serving as attorneys in the Armed Forces.

The second largest number of salaried lawyers work for private companies, including large manufacturing firms, banks, insurance companies, real estate firms, and public utilities. Most of the remainder teach in law schools. Some lawyers in salaried legal positions also have some independent practice; others do legal work on a part-time basis while primarily employed in another occupation.

Although lawyers practice in all parts of the country, most of them are in cities and in the States with the greatest population. In 1958, about 30 percent of all lawyers were in New York City, Chicago, Washington, D.C., Los Angeles, Boston, Detroit, Philadelphia, and Cleveland. Almost half were located in the following States: New York, California, Illinois, Ohio, Texas, and Pennsylvania.

Training and Other Qualifications

Before a lawyer can practice in the courts of any State he must be admitted to the bar of that State. In most cases, applicants must pass a written examination. In a few States, however, graduates of certain in-State law schools are admitted to the bar without examination. If a lawyer has been admitted to the bar in one State, he can usually be admitted to practice in another State without taking an examination, provided he is of good moral character and has a specified amount of legal experience. The right to practice before Federal courts and agencies is controlled by special rules of each court or agency.

To qualify for the bar examinations in most States, an applicant must have completed 2 or 3 years of college work and, in addition, must be a graduate of a law school approved by the American Bar Association or the proper State authorities. A few States permit graduates of correspondence law schools to take the bar examination, and some will accept study in a law office instead of, or in combination with, study in a law school—though this method of training is now rarely used. A number of States require registration and approval by the State board before students enter law school. In a few States, candidates must complete a period of clerkship in a law office after graduation from law school, before they are admitted to the bar examination.

As a rule, it takes 6 years of full-time study after high school to complete the required college and law school work. The most usual preparation for becoming a lawyer is 3 years of college study followed by 3 years in law school. However, law schools which have a 4-year, full-time curriculum may accept students after 2 years of college work. On the other hand, some schools require applicants to have a college degree. Specific college subjects are not generally required for entrance into law school. However, such courses as English and public speaking are important for prospective lawyers. Students interested in a particular aspect of the law may find it helpful to take related courses; for example, engineering and science courses would be useful to the prospective patent attorney, and accounting would be useful to the future tax lawyer.

Of the 158 law schools in operation in 1958, 129 were approved by the American Bar Association and the others—chiefly night schools—were approved by State authorities only. A substantial number of full-time law schools also have night divisions designed to meet the needs of part-time students; some law schools have only night classes. Four years of part-time study is usually required to complete the night-school curriculum. In 1958, more than one-third of all law students were enrolled in evening classes.

Although qualified young people interested in a legal career can usually obtain admission to a law school, they may not always be able to enroll in the school of their choice. Some of the better known schools have more applicants than they can accept. In selecting students, law schools consider college grades, amount of college education, the particular college attended, and recommendations made by college professors. A number of law schools require applicants to take the standard law school admission test, and several give their own aptitude tests.

The first 2 years of law school are generally devoted to fundamental courses such as contracts, criminal law, property, torts, and equity. The third year is composed largely of elective courses in specialized fields such as tax, labor, or corporation law. Practical experience is often obtained by participating in legal aid activities sponsored by the school, as well as in the school's practice court where the students conduct trials under the supervision of experienced lawyers. Upon graduation, the degree of bachelor of laws (LL.B.) is awarded by most schools, although a few confer the degree of juris doctor (J.D.) to graduates with high scholastic standing. Advanced study is often desirable for those planning to specialize in one branch of the law or to engage in research and law school teaching.

Most beginning lawyers start in salaried positions although some go into independent practice immediately after passing the bar examination. Young salaried attorneys usually act as assistants (law clerks) to experienced lawyers. As a rule, their work is limited to research such as checking points of law; they rarely see a client or argue a case in court. After several years of salaried employment, during which time they can obtain experience and funds and become well known, many lawyers go into practice for themselves.

Employment Outlook

Graduates from widely recognized law schools and those in the top 10 percent of their classes will have favorable employment prospects during the early 1960's. They are expected to have good opportunities for obtaining salaried positions with well-known law firms, on legal staffs of corporations and government agencies, and as law clerks to judges. Graduates of the less well-known schools and those with lower academic ratings are likely to experience some difficulty in finding salaried positions as lawyers. However, numerous opportunities will be available for law school graduates to enter a variety of salaried positions requiring a knowledge of law. Law graduates will also be in demand for legal positions in the Armed Forces. Young attorneys who open their own law offices after being admitted to the bar will, as in most other independent professions, generally face a period of low earnings while they build up their practices.

Prospects for establishing a new practice will probably continue to be best in small towns and expanding suburban areas since, in big cities, competition with other lawyers tends to be keener, overhead costs are higher, and the difficulties of becoming known to potential clients are greater. On the other hand, opportunities for salaried employment will be limited largely to big cities where the chief employers of legal talent—government agencies, law firms, and big corporations—are concentrated. For able and well-qualified lawyers, good opportunities to advance will be available in both salaried employment and private practice. Legal training will continue to be a valuable asset to people seeking public office.

Although the majority of employment opportunities for new lawyers will continue to arise from the need to replace those who retire, die, or otherwise leave the field, a gradual increase in the legal profession is expected over the long run. Most of the growth will result from the continuing expansion of business activity and population. The trend toward more complex legislation at Federal, State, and local levels points toward the need for more salaried lawyers as well as for more independent practitioners. In addition, the increased use of legal services by low- and middle-income groups—stimulated in part by lawyer reference plans and legal aid societies—will add to the long-term growth in demand for lawyers. The growing complexity of business and government activities is expected to create a steadily expanding demand for lawyers who are specialists in such fields as corporation, patent, administrative, labor, and international law.

Opportunities for women lawyers, who comprised less than 3 percent of the profession in 1958, will probably continue to be limited for some time to come. Although more than half of all women lawyers are employed in salaried positions, a substantial number are in practice for themselves. Many women lawyers hold positions, not as attorneys, but in occupations requiring a knowledge of law.

Earnings and Working Conditions

Beginning salaries for young lawyers are generally highest in large law firms and Federal agencies. In the Federal Government, the annual starting salary for attorneys who had passed the bar was either $4,980 or $5,985 in early 1959, depending on the applicant's qualifications. Inexperienced lawyers employed by medium-size law firms, corporations, and banks generally earn somewhat less, and those working for small law offices or engaged in legal-aid work usually receive the lowest salaries. The beginning lawyer in practice for himself may make little more than his expenses during the first few years and may add to his total income by engaging in other part-time employment.

In law, as in most other professions, earnings usually rise with experience. According to the most recent nationwide survey of lawyers' income (made by the U.S. Department of Commerce), annual earnings, above expenses, for lawyers in practice less than 5 years averaged about $5,000 in 1954. Lawyers in practice 15 to 19 years earned, on the average, about $11,700 a year, and those in practice 25 to 29 years earned nearly $13,200. Average annual income above expenses for all lawyers regardless of length of experience was $10,200. Earnings of lawyers practicing as partners were greater, on the average, than lawyers practicing alone. For example, average net income of sole practitioners was $7,315 in 1954; partners in 2-man firms each averaged $11,169; in 3-man firms, $14,830; and in firms of 9 or more members, $36,102.

Lawyers often work long hours and under considerable pressure when a case is being tried. In addition, they must keep abreast of the latest laws and court decisions. However, since lawyers in private practice are able to determine their own hours and workload, many stay in practice until well past 70 years of age.

Where To Go for More Information

The specific requirements for admission to the bar in a particular State may be obtained from the clerk of the Supreme Court or the secretary of the Board of Examiners at the State capital. Information on law schools and on law as a career is available from:

The American Bar Association,
1155 East 60th St., Chicago 37, Ill.

Librarians*

(D.O.T. 0–23.20)

Nature of Work

Librarians are concerned with making knowledge and information available to the public through such printed or recorded materials as books, periodicals, pamphlets, and reports. Since a growing number of libraries loan phonograph records, films, maps, and pictures, as well as books, librarians may also be concerned with these audiovisual mediums. Librarians select and purchase books and such other materials as the library loans or uses; classify, catalog, and circulate books and other loan items; publicize library services; investigate the reading interests of people served by the library in order to meet these needs; do research to secure facts or information requested; and provide reference service to guide readers of all ages to books and information suited to their individual interests.

Librarians may also collect, review, and abstract published and unpublished materials in order to prepare bibliographies and book reviews, which make information about books and other publications more readily available to the public. Some librarians serve as advisers to schools or business organizations on bibliographies and references for research, while others work with community groups, providing information and resource materials for use in their projects.

In a small library, the librarian may perform all of these duties. In a large organization, however, different librarians may handle each function, or may specialize in a particular subject-matter area, such as science, business, the arts, or children's books.

A number of libraries, both public and private, are devoted entirely to special subject-matter collections. These special libraries serve the interests of the employing organization rather than the wide range of public interest. For example, the library of a scientific research organization deals exclusively with materials suited to specified areas of research, an insurance company library concentrates on materials related to the insurance business, and the library of a government agency handles materials pertaining to the functions of that agency. These libraries employ persons called *special librarians* who, in addition to their regular duties, are often expected to take the initiative in furnishing information of particular interest or providing research services to the firm's or agency's administrative, management, or public relations offices.

A growing group of librarians called *extension-service librarians* work toward setting up and improving public libraries in areas where such services are inadequate or nonexistent. These librarians are employed by State agencies to travel about the State publicizing the need for improved library service, giving advice and as-

*Prepared by the Women's Bureau, U.S. Department of Labor.

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

The reference librarian guides readers to information suited to their particular interests.

sistance in organizing new libraries, and solving problems in existing libraries.

Where Employed

Librarians are employed in public libraries and in libraries maintained by public and private schools, colleges and universities, government agencies (including State libraries), research associations, medical institutions, and business and industrial firms. Some librarians work as teachers and administrators in schools of library science. By far the majority of librarians are women, and most of them are employed in public libraries or in the libraries of public schools. In recent years, more men have been entering this field partly because of the increased salaries being offered, the growing emphasis on library service in many fields, and improved opportunities for advancement to administrative positions due to the growing size of individual library systems.

The exact number of librarians is not known; however, according to a 1956 U.S. Office of Education survey, 17,500 professional librarians were employed in the 6,250 public library systems reporting. Earlier reports show that there were roughly 16,000 professionally trained librarians in the public schools in 1954. An estimated 8,700 librarians were working in college and university libraries in 1955. Agencies of the Federal Government employed more than 3,000 librarians in 1957.

Although most librarians are located in cities and towns, the bookmobile has been developed to serve large geographical areas. More than 1,000 bookmobiles were in use in 1957, servicing people who would otherwise have had to travel long distances to reach a library. Similarly, bookmobiles are used in some large cities where they have sometimes proven more effective and economical than regular branch libraries. They are particularly useful in rapidly growing suburban areas when establishment of branches would be premature.

Training, Other Qualifications, and Advancement

Completion of a 4-year undergraduate course in library science at a college or university qualifies graduates for positions as professional librarians in small libraries or for positions as assistants in large libraries. More than 550 colleges and universities offered some courses in library science in 1958. Some positions for special librarians are open to persons with specialized education and experience in a particular field, such as law, medicine, engineering, or business, even though they have had no library training.

In recent years, however, the trend has been toward requiring the completion of a 1-year course in a library school, after graduation from a 4-year college, in order to qualify as a "professional librarian." These graduate programs generally concentrate on the principles of librarianship rather than specific technical skills, and aim at qualifying students for responsible administrative positions.

Entrance requirements for professional (graduate) library schools commonly include: (1) graduation from an approved 4-year college or university; (2) a good undergraduate academic record; and (3) a reading knowledge of at least one foreign language. Most schools emphasize the importance of a general liberal arts program on the undergraduate level, and do not require previous training in library science. Skill in typing is regarded as a useful tool for library science students in connection with their work in areas such as cataloging. The length of time needed to complete work for the master's degree ranges from two to three semesters, with most schools requiring either two full semesters plus one summer session or three full semesters. In 1958, there were 31 graduate schools in the United States and Canada which were accredited by the American Library Association Committee on Accreditation.

Some scholarships for training in library science are available through State library agencies from funds appropriated under the Library Services Act passed by the U.S. Congress in 1956. Schools of library science offer scholarships, and students of library science are usually eligible to compete for general scholarships offered by many colleges and universities.

Some students attend library schools under cooperative work-study programs, combining their academic program with practical work experience in a library. This arrangement aids the students in financing their education, and at the same time is helpful in preparation for professional library service.

Those interested in public school librarianship must fulfill individual State certification requirements for school library posts. Most of these librarians will need to take some education courses, since nearly all States require teacher certification as a basis for the certification of school librarians.

Certain positions for special librarians require completion of courses dealing with the subject matter with which the librarian will work. The librarian who intends to specialize in a scientific field would need to take courses in mathematics and chemistry, physics, or engineering, depending upon the particular specialty; while the business librarian would study economics, business management, accounting, and finance.

Some librarians advance to the doctorate level in education for library science. Those persons who work in college and university libraries or teach in library schools find this type of training most helpful.

Duties of entrance positions vary according to type and size of the employing library. The library school graduate employed in a large public or university library may work under the direction of the chief of a specific library department, such as reference or cataloging. The beginning librarian in a small school or special library, however, may have duties that encompass all aspects of library operation. In all types of libraries, the more routine tasks are performed by beginning librarians.

Advancement for the librarian may come through transfer to a larger library or by promotion to a higher grade position in the same library. The careers of many librarians reveal considerable mobility among various institutions and types of specialization. Promotions to administrative positions or to specialized work are also possible after additional education or experience.

It should be noted, however, that advancement to higher level or specialized positions may be limited to "professional librarians" who have completed graduate training in an accredited library school or those who have special training and experience.

Certification is required for public librarians in 22 States. The requirements, based on different combinations of education and experience, may be established by local, county, or State agencies. These requirements should be investigated by the students through their high school or college counselors or the American Library Association.

Employment Outlook

Library schools, associations, and the U.S. Office of Education reported a nationwide shortage of trained librarians in 1958.

The number of degrees granted in library science has remained relatively constant, at less than 2,000 per year, over a long period of years, despite the rising numbers of job openings. Authorities in the field estimated that there were at least six vacancies for each library school graduate in 1957, so that the demand for trained librarians far exceeded the supply that year.

This demand is expected to continue and to increase well into the 1960's under the impetus of the Library Services Act of 1956, which provided Federal funds with State participation for the extension and improvement of rural public library service. The expanding school and college population and improved standards for these libraries will also necessitate the employment of a growing number of fully-trained librarians. Many additional openings will be created by turnover among young women in the field who leave their jobs for marriage and other reasons. Special librarians, particularly in science and technology, will be greatly in demand as a result of increasing emphasis on industrial research. Positions will continue to be available for persons interested in part-time work.

Over the long run, employment for librarians, particularly the specialists, is expected to expand, as more and more new information becomes available and the complexity of our sources of knowledge increases.

Earnings and Working Conditions

Geographical location, size of city, size and type of library, and degree of responsibility and technical skill required are important factors influencing librarians' salaries. In 1957, the average salary for beginning library school graduates was approximately $4,250 a year. Graduates with substantial previous experience in library work received an average of $550 more a year. Special librarians reported beginning salaries ranging from $4,200 to $4,500; higher amounts, up to $5,000 a year, were reported by technical librarians. Salaries for top-level positions in libraries generally range from $8,000 to $12,000, and approach $20,000 in some instances.

Entrance salaries in the Federal Government in 1958 were $4,040 and $4,980 a year, depending upon the extent of the individual librarian's education and experience. Many top-level positions offered salaries up to $10,000 with a few salaries reported over $11,000.

The typical workweek for librarians is 40 hours and often includes evening work in those libraries that remain open evenings. The 5-day week is becoming common, and the usual paid vacation after a year's service is 4 weeks. However, vacations may be longer in school libraries and somewhat shorter in those operated by business and industry.

Where To Go for Further Information

Additional information, particularly on accredited schools, requirements for librarianship, and scholarships or loans may be obtained from:

American Library Association,
50 East Huron St., Chicago 11, Ill.

Information on requirements and placement of special librarians may be secured from:

Special Libraries Association,
31 East 10th St., New York 3, N.Y.

Information about library services may be secured from:

U.S. Department of Health, Education, and Welfare,
Office of Education, Library Services Branch,
Washington 25, D.C.

Individual State library boards can furnish information on scholarships available through their offices, and requirements for positions in their State library systems.

Newspaper Reporters

(D.O.T. 0–06.71)

Nature of Work

Reporters gather information and write news stories for publication in daily or weekly newspapers. They interview people, consult police and public records, observe events as they happen, and do research in libraries. As a rule, reporters take brief notes while collecting facts and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone the information to other reporters, known as "rewrite men," who write the stories for them.

Big city dailies frequently assign some reporters to special "beats," such as police stations or courts, to cover news originating in these places, while local news which develops elsewhere is handled by general assignment reporters. News on certain subjects, such as sports, politics, and religion, is often dealt with by specialists in these fields. Reporters on small newspapers not only cover all aspects of local news but may also take photographs, write headlines, lay out inside pages, and even write editorials. On the smallest weeklies, they may also solicit advertisements, sell subscriptions, and perform general office work.

Newspaper reporting is only one of several occupations open to young people trained in journalism. Persons with this background may also work for general circulation magazines, trade, business, labor, and other specialized periodicals;

Newspaper reporter phoning in a story to the city desk.

for radio and television stations, advertising agencies, and public relations firms; and for government agencies. These related activities are not dealt with in this statement.

Of approximately 60,000 editors and reporters employed in the printing and publishing industries in 1950, it is estimated that about half were newspaper reporters. Although women composed almost one-third of the combined group, the proportion of newspaper reporters who were women was much smaller.

Where Employed

The majority of reporters are employed by daily newspapers and most of the others work for weekly papers. In addition, some reporters are employed by press services and newspaper syndicates.

Reporters work in cities and towns of all sizes throughout the country. Of the approximately 1,800 daily and 9,000 weekly newspapers published in 1958, the great majority were in small towns. Sizable numbers of reporters, however, are located in cities since each large city daily employs many reporters whereas a small-town paper generally has only a few.

Training, Other Qualifications, and Advancement

Although talented writers with little or no academic training beyond high school can become reporters, an increasing number of newspapers require applicants to have a college education. Some editors prefer college graduates with a degree in journalism while others consider a degree in liberal arts equally desirable.

Professional training leading to a degree in journalism can be obtained in more than 150 colleges; about 100 of these have separate departments or schools of journalism. The typical 2-year journalism curriculum is given during the junior and senior years of college and is about equally divided between cultural and professional subjects. Students preparing to become newspaper reporters take professional subjects such as reporting, copyreading, editing, feature writing, and the history of journalism. Graduate training is a relatively recent development and, although a number of schools award master's degrees, only a few offer programs leading to the doctor's degree in journalism. In 1958, most schools and departments of journalism were not overcrowded and qualified applicants had an excellent chance of admittance.

Young people who wish to prepare for newspaper work by obtaining a liberal arts background in college should take English and specialized courses in writing as well as such subjects as sociology, political science, economics, history, and psychology. Those without college training usually qualify by gaining experience on rural, small-town, or suburban papers. The ability to write well and to report the news accurately are important for success in this field, as are such personal qualities as a "nose for news," persistence, initiative, resourcefulness, and an accurate memory. A knowledge of typewriting is also necessary since reporters must usually type their own news stories.

Most beginners become "cub" reporters on weekly or small daily newspapers. However, some college graduates start as copy boys on large city papers and obtain promotions to reporting jobs. Other graduates are hired directly for reporting positions by some large newspapers that prefer to train them on the job. In competing for regular positions, it is helpful to have had experience as a "stringer"—one who covers the news in a particular area for a newspaper and is paid on the basis of the stories printed.

"Cub" reporters are assigned to such work as summarizing speeches, covering relatively unimportant meetings or interviews, writing obituaries, and handling minor news events. As they gain experience, they may advance to covering more important developments or are assigned to a "beat" or special subject. For experienced reporters, advancement is possible to positions such as columnist, or correspondent, or editor. Newspapermen also progress by moving to reporting jobs with larger papers or with press services and newspaper syndicates. Some reporters eventually advance to top executive positions or become publishers. Others transfer to related fields such as advertising, radio, television, or public relations.

Employment Outlook

Weekly or daily newspapers located in small towns and suburban areas will offer beginners the most opportunities to enter newspaper reporting during the 1960's. Openings continually arise on these papers as young people gain experience and transfer to reporting jobs on larger newspapers or to other types of work. Preference in employment on small papers is likely to be given to beginning reporters who are able to help with photography and other aspects of newspaper work and who are acquainted with the community.

Large city dailies will also provide some openings for inexperienced people with a good educational background to enter as reporter trainees, and a number of opportunities will continue to be available for young people to enter as copy boys and advance to reporting jobs. Newspapers are always looking for persons with exceptional talent; however, persons with only average qualifications generally encounter stiff competition in seeking advancement to the better reporting jobs.

In addition to jobs in newspaper reporting, new college graduates with journalism training will find numerous openings in related fields, such as advertising, public relations, trade and technical publishing, radio, and television. The broad field of mass communication, which has grown rapidly in recent years, will continue to expand in the 1960 decade. Factors pointing toward continuing expansion include rising levels of education and income; increasing expenditures for newspaper, radio, and television advertising; and a growing number of trade and technical journals and various types of company publications. Newspapers will share in this growth. Employment of reporters is expected to increase although not as fast as employment in some related areas. The greatest source of jobs for newspaper reporters will continue to result from the need to replace those receiving promotions to editorial or other higher level positions, transferring to other fields of work, or lost to the profession through retirement or death.

Special opportunities for women will continue to be found in reporting on such subjects as society news, food, fashions, clubs, and beauty culture for the women's section of newspapers. However, on many newspapers, women reporters are used on the same types of jobs as men.

Earnings and Working Conditions

Many daily newspapers have negotiated contracts with the American Newspaper Guild which set minimum wages based on experience and provide for annual salary increases. In early 1959, the minimum starting salaries on most daily newspapers with Guild contracts ranged from $55 to $75 a week for reporters without any previous experience. On a few small dailies, the minimum starting salaries were less than $50 a week; on the other hand, about the same number of large dailies paid beginning reporters $83 or more a week. Young people starting as copy boys earn less than new reporters.

Minimum rates for reporters with some experience (usually 4 to 6 years) ranged from $106 to $140 a week in early 1959, on most dailies organized by the Guild. Contract minimums for experienced reporters on a few small dailies were less than $100 a week; on a few large dailies they were more than $150 a week.

Especially promising beginners and qualified, experienced reporters are often paid salaries higher than the minimum rates called for in Guild contracts. Particularly successful, experienced reporters on city dailies may earn more than $200 a week.

Newspaper reporters on city papers generally work 8 hours a day, 5 days a week, although their hours are often irregular. Many of those employed by morning papers start work in the afternoon and finish around midnight. City papers pay overtime rates for more than 40 hours of work a week and often provide various employee benefits, such as paid vacations, group insurance, and pensions.

Where To Go for More Information

Information about opportunities with daily newspapers may be obtained from:

American Newspaper Publishers Association,
750 Third Ave., New York 17, N.Y.

Information on union wage rates is available from:

American Newspaper Guild, Research Department,
1126 16th St. NW., Washington 6, D.C.

Names and locations of all daily newspapers and a list of departments and schools of journalism are published in Editor & Publisher International Yearbook, available in most large newspaper offices and public libraries.

Personnel Workers

(D.O.T. 0–39.81 through .83, .85 through .88, and 0–68.70 through .78)

Nature of Work

Personnel workers are responsible for helping their employers hire and make the most effective use of workers. One part of their job is to develop recruiting and hiring procedures and to interview and evaluate applicants. Another is to keep personnel records and to prepare reports based on these records. In addition, personnel workers may counsel employees, handle disciplinary problems, classify jobs, plan wage and salary structures, develop safety programs, and conduct research in personnel methods. Employee training, the administration of retirement and other benefit plans, and labor relations—including negotiation of agreements with unions—are also important aspects of their work. (Personnel workers in schools and colleges who counsel students or are otherwise concerned with student problems are not dealt with in this report. See statement on School Counselors, p. 50.)

Many personnel jobs require only limited contact with people. Others involve frequent contact with employees, company officials, and people outside the company—for example, prospective employees, union officials, school personnel, and officials of community and other organizations.

Personnel work also involves many levels of responsibility, ranging from policy making to routine administrative activities, and includes a number of specialized functions. Industrial relations directors, personnel managers, training directors, and others in executive positions generally formulate policy, advise other company officials on personnel matters, and administer the departments they head. The greatest number and variety of personnel positions are to be found in big companies whose personnel programs include labor relations, wage administration, training, safety, job classification, and other specialized aspects of employee relations. In these organizations, the personnel department may have several hundred employees with highly specialized duties. Some business organizations limit their personnel activities largely to recruitment, handling of disciplinary problems, and maintenance of personnel records; these companies employ fewer personnel workers. In a small business, one person may handle all the personnel work and in some cases, also have other duties.

Where Employed

Personnel workers are found in nearly all types of business enterprises as well as government agencies. Of the more than 50,000 personnel and labor relations workers employed in 1958, well over half worked for private industry. Industries employing large numbers of personnel workers include steel, automobile, and machinery manufacturing, telephone and other utilities, department stores, petroleum refining, and chemicals. About one-third of all personnel and labor relations workers are employed by Federal, State, and local government agencies, chiefly by the Federal Government. In addition, a number are college teachers of personnel administration, industrial relations, and similar subjects. Some work independently, generally as management consultants or labor relations experts. Most per-

Personnel director explaining training program to department heads.

sonnel workers are located in big cities and in the highly industrialized sections of the country.

Training and Other Qualifications

A college education is becoming increasingly important for personnel work. However, many personnel executives are not college graduates but entered the field by advancing from production, sales, or clerical jobs, and this method of entry is still open for some personnel jobs in private industry. For professional positions with the Federal Government, a bachelor's degree is generally needed. Some specialized positions in both private industry and government service require advanced training beyond the bachelor's degree.

College courses in personnel management, business administration, public administration, applied psychology, statistics, economics, political science, sociology, English, and public speaking are regarded as desirable preparation for personnel work. Although some employers in private industry prefer college graduates who have majored in personnel administration, many consider such training too specialized and prefer those with a general business administration background. Other employers consider a well-rounded liberal arts education the most desirable preparation for personnel work. Young people interested in government positions are often advised to major in public administration, political science, or personnel administration; however, those with other academic backgrounds are also eligible for government employment.

For some positions, more specialized training may be necessary. Jobs involving testing and counseling often require a bachelor's degree with a major in psychology or even a graduate degree in this field. An engineering degree may be needed for work dealing with time study or safety standards, and a degree with a major in industrial relations may be helpful for work involving labor relations. A background in accounting and law is also very useful for positions dealing with wages, pension and other employee benefit plans.

Many employers prefer personnel workers who have had firsthand experience with the operations of the company and with the type of work performed by the employees. For this reason, firms often recruit new personnel staff members from their own employees—in which case, other qualifications often outweigh educational background. On the other hand, some companies and government agencies hire only college graduates and put them through in-service training programs that teach both the operations of the organization and specific personnel procedures. College graduates may also be employed directly for beginning jobs in personnel work as junior interviewer, personnel clerk, assistant job analyst, or labor relations assistant.

Qualities regarded as important for success in personnel work include the ability to speak and write effectively, and more than average skill in working with people of all levels of intelligence and experience. In addition, the prospective personnel worker should have a liking for detail, a high degree of persuasiveness, and a pleasing personality.

Employment Outlook

A number of opportunities for professional employment in personnel work will be offered in the early 1960's, through in-service training programs for junior personnel workers conducted by large companies and Federal Government agencies. However, many new graduates seeking to enter professional personnel positions are likely to continue to face keen competition in various parts of the country. In general, employment prospects will be best for college graduates with specialized training in such areas of personnel work as industrial relations, psychological testing, and safety engineering. Some opportunities to advance to personnel work will be available for qualified young people willing to start in production, clerical, or subprofessional positions.

A gradual increase in the demand for personnel workers is expected over the long run. The anticipated expansion in the country's labor force and the trend toward larger companies will create a need for more personnel workers to carry on recruiting, recordkeeping, and related activities. In addition, a marked growth is expected in some specialized areas of personnel work. Increased recognition of the importance of the "human factor" in industry will bring about a demand for more executives trained in employee relations; wider use of psychological testing by employers will result in a need for additional staff; and growth of in-service training programs and their application to new problems will increase the size of training staffs. The demand for more labor relations experts is also expected to continue. Extension of employee services, growing emphasis on safety, retraining of employees owing to technological changes, development of pension and other benefit plans, and intensified research activities also point toward a future demand for more trained personnel workers. Moreover, additional workers will be needed to replace those lost to the field through retirement or death and for other reasons.

Opportunities for women, who constitute approximately one-fourth of all personnel workers, are expected to continue to expand. Prospects will remain best in organizations which have many women employees such as department stores, telephone companies, and government agencies. Although advancement opportunities will probably continue to be limited, a growing number of women are expected to attain top positions.

Earnings and Working Conditions

Beginning salaries for men college graduates in professional personnel positions in large companies averaged about $4,800 in 1958, according to reports from college placement directors. In the Federal Government, beginners with bachelor's degrees started at $4,040 a year and those with master's degrees at $4,980, in late 1958. Prospective personnel workers who held clerical, production, or subprofessional positions generally earned lower salaries.

The average annual salary paid directors of personnel, industrial relations directors, and others in top positions was approximately $12,000 in 1958, according to a survey made by a large university. However, their annual salaries ranged from less than $5,000 in some small companies to more than $60,000 for vice presidents in charge of personnel or industrial relations in some giant corporations.

Employees in most personnel offices generally work 40 hours a week. However, during periods of intensive recruitment, strikes, or other unusual situations, considerable overtime work may be required. As a rule, personnel workers are paid for holidays and vacations.

Where To Go for More Information

General information on personnel work as a career may be obtained from:

The American Society for Personnel Administration,
Kellogg Center, East Lansing, Mich.

General information about public service careers, including personnel work, may be obtained from:

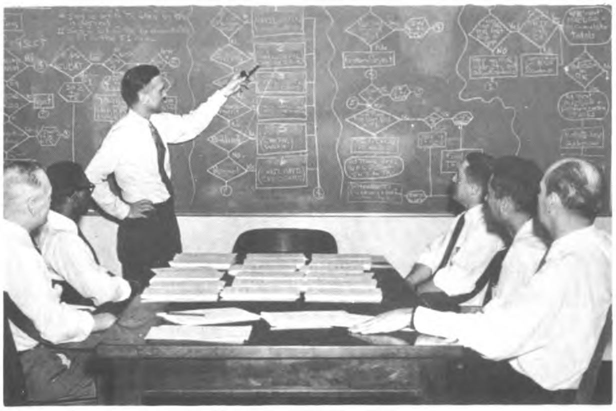
Public Personnel Association,
1313 East 60th St., Chicago 37, Ill.
American Society for Public Administration,
6042 Kimbark Ave., Chicago 37, Ill.

Programmers

(D.O.T. 0–69.981)

Nature of Work

The occupation of programmer is one of the newest in the country. People in this occupation prepare instructions or "programs" for the great new electronic computers, specifying exactly what steps these machines should take to get the desired results. Electronic computers are



COURTESY OF U.S. VETERANS ADMINISTRATION

Senior programmer pointing out steps in a flow diagram to other members of a programming team.

often called "giant brains"; however, it is the programmer who does the thinking that makes the machines work. The instructions which programmers prepare are put on cards or paper tapes punched with holes, or magnetic tapes with special markings. The electronic computer can then carry through millions of computations—adding, subtracting, multiplying, and dividing—at lightning speed. The machines ("peripheral" equipment) used with the computers, and run by office machine operators, include *converters* which transfer information from punched cards to magnetic tape (or the reverse operation); *readers* that make the instructions on the tape or cards usable by the computer; and *printers* that record the final results in a form that can be read.

Programmers usually specialize in one of two main types of work on which computers are used —processing the great masses of data which have to be handled in large business and government offices, or solving scientific and engineering problems. In business and government offices, programmers work out plans which make it possible for electronic computers to take over a vast amount of clerical work formerly done by hand or slower machine methods—for example, preparing payrolls, making out customers' bills, and doing inventory control work. Programmers in government offices may also be concerned with projects involving masses of statistical data—for example, compiling information collected by the Bureau of the Census or analyzing income-tax returns—or with special research projects. The other major group of programmers plan how to use computers to solve complex mathematical problems dealing with the control of machine tools used in manufacturing processes, and in connection with scientific and engineering projects, such as launching and tracking earth satellites and forecasting weather.

There are four main steps in programming—analyzing the problem, preparing a flow diagram, writing detailed instructions, and making sure the program works on the computer. The programmer uses his knowledge of what the computer can do and his familiarity with the subject matter of a problem to plan the most efficient way of using the computer. For example, in planning to use an electronic computer to do the vast amount of clerical work involved in making up a payroll—computing gross and net pay, typing and sorting pay checks, and keeping records—the programmer analyzes how payroll records are prepared. To understand the kinds of reports needed and their timing, he may have discussions with company personnel at all levels. When all the information is assembled, the programmer prepares a flow chart showing the logical order in which various operations must be performed by the machines. He then writes the many hundreds—sometimes thousands—of program instructions. The final instructions are coded—either by the programmers or by clerks—into special machine language which is converted into holes on punchcards and paper tapes, or marks on magnetic tapes. (See statement on Office Machine Operators, p. 230.) Finally, the programmer must have several trial runs of the cards or tapes made on the computer in order to "debug" his program (check its accuracy) before turning the machine over to the computer operator. To complete the entire programming process may take a few months or a year or longer, and the instructions prepared may fill several bulky volumes.

Programmers engaged in solving scientific or engineering problems also perform analytical work, prepare flow charts, write instructions, and test their programs. In this work, however, the programmer deals chiefly with scientists and mathematicians who give him the problem in complicated mathematical formulas which he has to simplify into arithmetic forms the computers can handle. This "numerical analysis" can be applied to many types of research problems; for

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example, in connection with missile designing, the computer can be used to give answers to a variety of simulated flight problems. The basic idea is to imitate mathematically a physical situation and, by solving the equations, anticipate the results without actually seeing or doing an experiment. In one of the newest applications, a few programmers prepare instructions for the electronic devices that control machine tools in factories; these devices make it possible to produce aircraft parts and other products with greater precision and speed than when machines are controlled by human beings. In this type of work, sometimes called "numerical control" of machine tools, programmers often work closely with engineers and skilled machinists.

In big offices with large computing systems, several programmers at different levels of responsibility may work as a team on one problem. A senior programmer may have overall responsibility for the entire program and may direct other programmers. Beginning or junior programmers are usually assigned to write specific parts of broad programs. Methods, systems, or procedure analysts are sometimes employed to do most of the analytical work required for programming and to make recommendations as to whether a particular operation can be handled efficiently by a computer.

Where Employed

Several thousand programmers were employed in 1958, chiefly in the large metropolitan areas where the main offices of big corporations and government agencies are located. Insurance companies, public utilities, and government agencies are among the leading employers. Programmers are also employed in many manufacturing industries—electrical equipment, petroleum products, chemicals, aircraft, automobiles, and others—in scientific and engineering laboratories, and in newly established computer centers.

The number of programmers employed by a company depends not only on the size and the number of electronic computers in use, but also on the number and complexity of the operations being programmed. A company with one large computer may employ from 10 to 30 or more programmers; one with a medium-size computer may have only 2 or 3 programmers. A number of large companies have several giant computers, although usually only one is installed at any single office or plant. At each location, one or more medium-size or small computers may also be used.

Training and Other Qualifications

Companies have been filling most positions in this new occupation by selecting employees familiar with the subject matter to be programmed and giving them training in programming work. Since many of the office operations which are being taken over by electronic computers involve accounting work, employees with experience in accounting departments have often been selected for programmer training. However, new college graduates are sometimes hired as trainees, particularly for programming scientific work.

Men are preferred as programmer trainees in most areas of work. Although many employers recognize the ability of women to do programming, they are reluctant to pay for their training in view of the large proportion of women who stop working when they marry or when they have children. Opportunities for women to be selected as trainees are likely to be better in government agencies than in private industry.

To find out which individuals have an aptitude for programming and should therefore be selected for training, most companies give general intelligence tests and special tests which measure the ability to think logically and do abstract reasoning, and then interview the people with the highest test scores. Personal characteristics considered important for this occupation include patience; a logical and systematic approach to the solution of problems; and the ability to work with extreme accuracy, paying close attention to detail. Imagination is also an asset, since programmers often have to devise new ways of attacking a problem.

Training in programming is usually given at company expense—often in special schools established by the manufacturers of electronic computing equipment, although large companies which have used computers for several years are beginning to develop their own training programs. Trainees usually spend a few weeks in lecture courses, combined with practical demonstrations of the electronic computing system used by their company. After completing the basic program, trainees practice writing and coding instructions and testing them on the computers. Those who complete this basic program satisfactorily are finally selected as programmers and are usually given several weeks of additional preparation at the company before starting on their first regular assignments. Further training is generally necessary when a company introduces a new type of computer.

Educational requirements have been changing rapidly in this new occupation and may continue to do so. A college degree or equivalent experience is required for all entry programming positions in the Federal Government. In private employment, college graduation is less likely to be required for programmers of office data, although courses in business administration including accounting and statistics are very helpful. Many employers no longer stress a strong background in mathematics for programming of business or other mass data if candidates can demonstrate an aptitude for the work. However, programmers of scientific and engineering problems are usually college graduates with a major in one of the sciences or in engineering and some courses in mathematics.

A growing number of courses in electronic data processing are becoming available in colleges and universities. Such courses help young people to decide whether they like this type of work and may also help experienced programmers to advance to higher level jobs. About 15 colleges and universities have computing centers and offer programs of computer training including basic courses, such as the mechanics of computers; the general logic of programming, and coding for computers; and also advanced courses for managerial personnel. Many other colleges offer one or more courses relating to the use of electronic computers.

Chances for advancement are good in this expanding occupation. In large companies, the junior programmer may become a full-fledged programmer after a year or two of experience and later may be promoted to senior programmer in charge of a team of programmers, or perhaps to methods, systems, or procedures analyst. Promotion is also possible to higher positions, such as manager in charge of program analysis, manager of the computing center, and vice president in charge of methods research.

Employment Outlook

Employment opportunities for programmers are expected to remain very favorable through the early 1960's. Additional programmers will be needed both by employers already using electronic computers and by those planning to install such equipment. Fewer openings are anticipated in the scientific and engineering field than in programming of office and other mass data. However, the number of qualified candidates for programmer jobs may also be smaller in the technical field, since college graduates with a background in mathematics, science, and engineering—who are preferred for these programming jobs—will be in strong demand for many other types of work.

Continued expansion in employment of programmers is expected over the long run, owing to the same general factors which have led to the increased use of electronic computing systems in the recent past. In offices where the volume of recordkeeping is great, there will continue to be need to reduce the cost of processing tremendous amounts of data and to produce better, more timely reports on which management decisions can be based. Expenditures for scientific and engineering research and development are expected to remain high, and electronic computers will be used as an aid in solving, with extraordinary speed, more and more scientific and engineering problems. Computers will also be used increasingly to work out problems connected with automation of factory processes. Thus, employment of programmers will grow, as additional business establishments and government agencies install their first computers and others expand their computing systems. The Federal Government, which had approximately 100 automatic data-processing installations operating in connection with office-type work in June 1957, planned to install about 35 more shortly thereafter. An increasing number of small companies are expected to acquire computers and employ programmers, owing to the development of smaller, less expensive equipment designed for use where the volume of work is not large enough to warrant the purchase of elaborate equipment. Furthermore, replacement needs resulting from retirement and death of programmers will provide an increasing number of job openings in the years ahead, since many persons trained in the 1950's were mature employees with several years of working experience.

New technological and other developments may affect the amount and quality of the work of the programmer. For example, the use of programming libraries (files of tested programs) and automatic programming has already eliminated some of the routine work necessary in programming. Extensive use of such aids may reduce the need for some types of programmers and raise the qualifications required for others. Another development which may affect employment opportunities in this occupation is the establishment of additional computing centers which would perform services for clients on a fee basis. Pooling of work in these centers may lead to some reductions in the number of programmers needed by individual companies. Any decreases of this kind, however, are likely to be more than offset by expansion in the programming staffs of the centers, which look forward to a great amount of business from small companies.

Earnings and Working Conditions

Information on programmers' salaries in companies which use large electronic computing systems mainly for office-type operations indicates a wide range in salary levels. This results partly from differences in the complexity of programming operations and the fact that salary levels have not yet become well established in this new occupation. Junior or beginning programmers had starting salaries ranging from $3,600 to $5,400 a year in 1957. Salaries are generally increased annually for a few years—up to maximums of $4,500 to $7,100 for junior programmers. Minimum salaries of experienced programmers promoted to the semisenior level generally ranged from $4,500 to $6,500, and their maximum salaries were from approximately $6,000 to more than $8,500. At the senior programmer level, the range of minimum salaries was from $5,200 to nearly $8,000 annually, and maximum earnings were from about $7,000 to approximately $12,000. Higher salaries are earned by top-level administrators responsible for programming work.

The Federal Government paid most beginning programmers $4,040 a year in mid-1958. Some with higher qualifications received a starting salary of $4,980.

The standard workweek for programmers is usually 35 to 40 hours, depending on the industry in which they are employed. Although the operators of computing systems (those at the computer's control panel, or operators of the machines that convert and print information) may be on a two or three shift basis, programmers only occasionally work evenings or weekends—for example, when they have difficulty "debugging" a program. Like most other officeworkers, programmers usually receive liberal vacations, paid holidays, and sick leave, and are also covered by life insurance, pension, hospital, medical, and other employee benefit plans.

Programmers usually work in well-lighted, air-conditioned modern offices. Employers make special efforts to provide better than average surroundings for programmers, so that they may concentrate to achieve the extreme accuracy necessary for programming.

Where To Go for More Information

Persons interested in programming jobs can apply directly to large companies that have or are planning to install electronic computing systems.

Information on companies that had electronic data-processing equipment early in 1957 is available in:

> A Second Survey of Domestic Electronic Digital Computing Systems, U.S. Department of Commerce, Office of Technical Services, 1957. Price $7. Available from the Department of Commerce, Washington 25, D. C.

Information about programmer jobs in government agencies can be obtained from the U.S. Civil Service Commission and from the appropriate local civil service agencies.

Psychologists

(D.O.T. 0–36.21 through .26)

Nature of Work

Psychologists seek to explain how our minds work and why we act as we do. They study the behavior of people, develop tests which measure aptitudes and personality, and use test results and other techniques to assist them in understanding individuals. The work of psychologists includes such varied activities as teaching in colleges and universities, diagnosing and treating mental disorders, counseling individuals, assisting in selecting workers for jobs, and conducting research. Altogether, an estimated 24,000 psychologists were professionally employed in early 1959. Approximately one-fourth were women.

Psychologists may be divided into two major groups: Specialists in the applied fields who generally work directly with people, and specialists in the basic science fields who are mainly employed in research or in college and university teaching. More than three-fourths of all psychologists are in the applied specialties—engaged chiefly in applying psychological principals and methods to help individuals adjust successfully to home, social, school, and working situations.

Clinical psychology is the largest applied specialty; about one-third of all psychologists are in this field. Clinical psychologists generally work in mental hospitals or clinics and are concerned primarily with problems of maladjusted or disturbed people. They interview, give diagnostic tests, and provide individual or group psychotherapy. Specialists in counseling and guidance, the second largest field, help students, the physically handicapped, and other individuals achieve educational, vocational, and social adjustment. School psychologists administer intelligence and other diagnostic tests to children, interpret the results, and suggest remedial action when necessary. Psychologists specializing in the other applied fields (industrial and personnel, human engineering, and educational psychology) may act as management consultants, select and train personnel, assist in designing equipment for the most efficient utilization, or develop improved teaching methods.

Specialists in the basic science fields conduct research not only in colleges and universities but also in a variety of other organizations such as mental hospitals or in Government agencies. A few examples of research problems in the basic science fields of developmental, experimental, comparative, and social psychology are: How age is related to learning ability; how the brain functions under conditions of extreme fatigue; how different living conditions affect the behavior of animals; and how attitudes change as a result of group living.

COURTESY OF NATIONAL INSTITUTES OF HEALTH

Psychologists use tests to learn about children's abilities.

Where Employed

The places where psychologists work range from college classrooms to hospital wards and from research laboratories to business offices. Although most psychologists are employed in large cities and in university towns, a sizable number are on the staffs of institutions located in rural areas.

Colleges and universities employ the largest number of psychologists—more than one-third of the total. Government agencies—Federal, State, and local—employ the second largest group. Within the Federal Government, the agencies which have the most psychologists are the Veterans Administration, the Department of Defense, and the Public Health Service of the Department of Health, Education, and Welfare.

Sizable groups also work for elementary and secondary schools, private industry, and for nonprofit foundations, hospitals, and clinics. A small number are in independent practice, and a few serve as commissioned officers in the Armed Forces and the Public Health Service. In addition to positions with the title "psychologist," there are many personnel and administrative jobs filled by persons trained in psychology.

Training and Other Qualifications

The master's degree with a major in psychology is usually the minimum requirement for professional employment as a psychologist. The Ph. D. is needed for some beginning jobs and is becoming increasingly important for advancement. Although the bachelor's degree is not considered sufficient education for professional employment, some young people with this degree secure routine jobs in work related to psychology or other fields where training in psychology is helpful.

A minimum of 1 year of full-time graduate study is needed to earn the master's degree in most psychological specialties, and many students take longer. In clinical and counseling psychology, the minimum time needed to earn the master's degree is 2 years in many schools which include practical training in their master's degree programs. The Ph. D. degree requires a total of at least 3 or 4 years of graduate work. In clinical or counseling psychology, a Ph. D. usually requires 4 or 5 years of advanced study, including 1 year of internship or supervised experience.

Advanced training is most commonly obtained in graduate departments of psychology. In some universities, however, other departments—generally schools of education—also grant degrees which qualify students as psychologists. An undergraduate major in psychology is required for enrollment in some schools; others prefer students with a more general educational preparation. Basic psychology courses supplemented by the biological and physical sciences, statistics, and mathematics are among the most frequent requirements. Most universities have more applicants for graduate study in psychology, particularly for the Ph. D., than can be accepted. Students are selected primarily on the basis of college grades and performance on aptitude tests. Emotional stability, interest in people, and social maturity are considered especially important for those preparing to enter the applied fields.

Many graduate students receive financial help from universities and other sources, either in the form of part-time employment as assistants or outright grants (fellowships). Several Federal agencies provide funds to graduate students, generally through the educational institution giving the training. The Veterans Administration offers a large number of 4-year doctoral traineeships, chiefly in clinical and counseling psychology, during which time the students are paid for part-time employment with that agency. The Public Health Service of the U.S. Department of Health, Education, and Welfare supports doctoral fellowships in psychology. The Office of Vocational Rehabilitation of the same Department offers 2-year traineeships in vocational rehabilitation counseling, primarily for those working toward the master's degree.

Beginning psychologists with the master's degree qualify for jobs assisting in the administration and interpretation of psychological tests, analyzing and collecting statistical data, helping in research experiments, performing routine administrative duties, and acting as vocational rehabilitation counselors. In addition, they may teach in colleges, assist in counseling college students, or—if they have had previous teaching experience—act as school psychologists or counselors (see statement on school counselors, p. 50). Those with doctorates are eligible for more responsible research, clinical, and counseling positions as well as for better paid positions in colleges and universities.

To obtain government employment, psychologists must usually qualify through a Civil Service system. Many entrance positions in the Federal Government require the doctorate or the equivalent in education and experience. Those desiring to enter independent practice must meet certification or licensing requirements in an increasing number of States. Fourteen States—Arkansas, California, Connecticut, Florida, Georgia, Kentucky, Maine, Maryland, Minnesota, New Hampshire, New York, Tennessee, Virginia, and Washington—had such requirements in mid-1958.

Employment Outlook

Employment of psychologists is expected to grow substantially during the 1960's. A strong demand for psychologists with Ph. D. degrees will exist in every field of specialization and in virtually all parts of the country. Those with master's degrees will also be in considerable demand, but their opportunities for full professional employment may become more limited owing to increasing emphasis on the doctorate as a requirement for independent practice and for the more responsible salaried positions.

Many factors point toward continued rapid expansion of this profession, which tripled in size between 1945 and 1955 and has since grown by almost 1,500 annually. Although population growth alone accounts for some of the increased need, the following long-term trends are more directly responsible: Increasing recognition by schools, government agencies, private industry, and the public of the contributions that can be made by this relatively new science; growing concern about mental health needs, resulting in a tremendous increase in State funds available for the treatment of the mentally ill; and the emergence of the Federal Government as a major sponsor of psychological research not only within the Government but also in universities and private industry.

A large growth is anticipated in the number of psychologists employed by State agencies. Currently understaffed mental hospitals and mental hygiene clinics will need many clinical psychologists. Prisons, training schools, and other State institutions are expected to use psychologists more extensively. Employment of vocational rehabilitation counselors in State programs is expected to increase from 2,600 in 1958 to more than 5,000 in the mid-1960's, and will draw upon psychologists and others with the master's degree who have specialized in rehabilitation work.

Increasing awareness of the need for testing and counseling children, coupled with the availability of Federal funds for this purpose, is expected to increase the employment of school psychologists and counselors in both elementary and secondary schools. In colleges and universities, more psychologists will be needed in student personnel work, as well as in teaching, to meet growing enrollments during the 1960's (see statement on college and university teachers, p. 47). The trend toward greater use of psychological techniques by private industry is likely to continue, thereby creating new openings for experimental, industrial, personnel, and human engineering specialists.

The Federal Government will remain an important source of employment. Many openings for psychologists with Ph. D. degrees are expected at the Veterans Administration, chiefly in clinical and vocational counseling positions in hospitals for veterans. The Department of Defense will probably continue to have some openings for research psychologists who are specialists in experimental, human engineering, physiological, and personnel psychology. It should be kept in mind, however, that the number of Government positions is dependent on funds appropriated annually by Congress.

In addition to newly created jobs, some vacancies will occur each year owing to retirements and deaths. However, such openings will be relatively few during the early 1960's because psychologists are a young group. The transfer of psychologists to work of a purely administrative nature may also create some job vacancies.

Most employment opportunities for women psychologists will probably continue to be in clinical psychology, where about half the women psychologists are currently employed. However, the expected expansion of school counseling and guidance programs may offer women psychologists, especially those with previous teaching experience, a growing number of employment opportunities during the 1960's. Women may continue to find opportunities limited in psychological consulting firms, in some kinds of military research, or in industrial psychology.

Earnings and Working Conditions

Beginning salaries in late 1958 were estimated to be, according to the limited data available, between $4,500 and $5,500 a year for psychologists with master's degrees and between $6,000 and $7,000 for Ph. D.'s. However, in the Federal Government, psychologists with the doctorate and limited experience could start at about $7,000.

Salaries offered experienced psychologists with master's degrees were typically between $5,500 and $7,500 in 1958. For Ph. D.'s, the range was generally between $7,000 and $10,000. In some fields, salaries for psychologists in top positions were well over $10,000 a year.

Private industry and psychological consulting firms generally pay the highest salaries to psychologists, and the Federal Government the next highest. Colleges, universities, and school systems usually offer less. Average salaries among psychologists employed by State and local governments or private nonprofit organizations tend to be somewhat lower still. Women psychologists earn, on the average, less than men with equal education.

Total earnings of psychologists are frequently higher than the salaries given above, since a large number do part-time work in addition to their regular salaried jobs. Many small mental hospitals or clinics employ psychologists only on a part-time basis. Psychologists whose regular employment is outside the academic field often teach part time in colleges and universities. In turn, college teachers frequently act as part-time consultants or have a private practice.

Where To Go for More Information

General information on the profession, placement opportunities, certification or licensing requirements, and also a list of universities with approved doctoral programs in clinical and counseling psychology may be secured from:

American Psychological Association,
1333 16th St. NW., Washington 6, D.C.

Information on traineeships and fellowships may be secured from colleges and universities with graduate psychology departments and from the following Government agencies:

Chief, Vocational Counseling, Department of Medicine and Surgery, Veterans Administration, Washington 25, D.C., or Chief, Clinical Psychology Division, Veterans Administration, Washington 25, D.C.

Chief, Division of Training, Office of Vocational Rehabilitation, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

Training and Standards Branch, National Institute of Mental Health, National Institutes of Health, Bethesda, Md.

Social Workers*

(D.O.T. 0–27.06 through .50)

Nature of Work and Where Employed

Social workers help people who have individual or family difficulties which interfere with healthful and useful living. They arrange for counseling services, job guidance, monetary grants, medical care, or other types of aid. To help people improve their social relationships, as well as aid in the normal process of growing up, some social workers conduct leisure time programs and informal educational activities. Others are engaged by communities to help plan and develop health, welfare, and recreation services on a broad scale for a neighborhood or larger area.

Of the nearly 100,000 social workers in the country, about two-thirds are government employees, working mainly on public assistance or other welfare programs administered by State, county, or city governments. The remainder are employed by private agencies, which are supported by contributions, endowments, or fees paid by those served. More social workers are employed in urban than in rural areas. At present, men comprise about one-third of the social workers and their representation is slowly increasing.

Social Caseworkers. Most social workers are caseworkers, who deal directly with individuals and families having difficulties relating to lack of income, poor household management, ill health, or poor relationships between husband and wife or parent and child. The efforts of social caseworkers often keep together a family on the verge of breaking up. They may arrange for medical care or the distribution of food and clothing and may assist those able to work to find a job. Through relationships with social workers, the attitudes and behavior of clients may be modified so that they are able to care for themselves and their families more effectively.

The largest single group of social workers, possibly as many as 40,000, are *family caseworkers* engaged in public assistance or other government welfare programs which provide financial aid for

*Prepared by the Women's Bureau, U.S. Department of Labor.

needy persons, including the disabled, blind, aged, or unemployed and for children lacking one parent or both. These caseworkers must establish the financial eligibility and needs of their clients, explain pertinent laws and requirements, and assist in obtaining any other social services needed.

An additional 6,000 family caseworkers are employed by private agencies, such as those affiliated with the Family Service Association, Catholic Charities, Jewish Family Service, various Protestant churches, the Salvation Army, and the National Travelers' Aid. Caseworkers in private organizations generally provide more intensive counseling services than public agencies, concentrating on the strengthening of family life and the establishment of satisfactory relationships between the family and the community. As private agencies generally have access only to emergency funds, they refer financially needy persons to public assistance agencies.

Government and private agencies together employ an estimated 15,000 *child welfare workers* who help children with difficult family relationships, behavior problems, and mental or physical handicaps. The duties of these caseworkers include finding foster homes for neglected or abused children, arranging when necessary for adoption or placement in specialized institutions, counseling a youthful offender who has been brought before the juvenile court, and providing crutches or braces for a crippled child.

More than 1,000 *school social workers*, often called visiting teachers, are employed on a full-time basis by school systems—usually for work in elementary schools in large cities. They consult with teachers, principals, parents, physicians, and any others who can assist in understanding and aiding a maladjusted or disturbed child. In cases of poor school attendance and other unsatisfactory behavior, school social workers usually visit the home to learn more about the child's family and community life. They also give guidance to very aggressive or excessively shy children and seek to learn why an intelligent child is doing poorly in school work. Children may be referred by school social workers for help to other community services, such as clubs or clinics.

Probably more than 6,000 *medical social workers* serve as members of medical teams aiding patients whose recovery is delayed by emotional problems. Employed mainly by public health departments, hospitals, and health centers, they work with all types of patients, including those receiving medical care for poliomyelitis, tuberculosis, cancer, and heart disease. Medical social workers may, for instance, aid a child amputee develop a more healthful attitude toward his handicap, work with an uncooperative patient shying away from surgery, or instruct a discharged patient's family on his diet and care. They keep complete records of each patient's progress and help interpret the physician's recommendations to both the patient and his family.

About 2,500 *psychiatric social workers* are employed in mental hospitals and clinics as part of a psychiatric team along with doctors, nurses, and psychiatrists. They participate in planning for a patient's recovery, interpreting his problems and progress to his family, and assisting him both during his stay in the hospital and after he returns home.

The largest employer of medical and psychiatric social workers (or "clinical workers") is the Veterans Administration, which had about 1,320 of these workers in 1958.

Although the majority of medical and psychiatric social workers are caseworkers, a growing number of these social workers are being engaged by hospitals and clinics to work with groups of patients.

Caseworkers in rehabilitation work assist emotionally ill or disabled persons in adjusting to the needs of everyday living. Part of a rehabilitation team, which usually includes physical or occupational therapists, these social workers serve as a link between the patient and the community while he is in the hospital and continue to help him adjust to home and community life.

Social Group Workers. These workers are interested primarily in using group experience to further the development of the individual. They work with organized groups of all ages. In their efforts to encourage socially desirable behavior, they organize such leisure-time activities as handicrafts, games, hikes, and dancing. Much of their work is with healthy boys and girls. Frequently they work also with elderly people, emotionally disturbed people, delinquents, and adult offenders. For example, under the guidance of a fully qualified social worker—generally called a youth-board worker—a special program may be organized to help channel the interests of delinquent youths from street gangs to sports or other constructive activities. Social group workers may also train and direct volunteer workers as group leaders or assistants.

Many of the approximately 10,000 social workers in this field are employed by settlement or community houses, churches, and such youth-serving agencies as the Boy Scouts, Girl Scouts, and Camp Fire Girls. About 2,000 work for the American Red Cross and others for public recreation departments and camps. A small but gradually increasing number are on the staffs of medical psychiatric social service units in hospitals and clinics. Occasionally, housing projects employ social group workers to organize and direct activities among the residents.

Community Organization Workers. Community chests, community welfare councils, and other community agencies which have broad responsibilities for health, welfare, and recreation services also employ social workers. It has been estimated that these agencies have as many as 5,000 social workers on their staff. Some community organization workers set up and conduct fundraising campaigns and supervise the disbursement of funds as directed by the community council. They may recruit and train volunteer workers, work with community leaders, and plan necessary publicity. They may also determine whether additional social organizations are needed, and they may recommend changes in existing ones to avoid duplication of effort.

Other Social Workers. Social workers are employed in a number of other specialties. Probably more than 3,000 are engaged in correctional work with persons on probation or parole. Some 800 teach in graduate schools of social work; almost half of the teachers work part time. An estimated 500 specialists are engaged in social work research in large cities and in research centers, studying the aims and purposes of social work, measuring the effectiveness of current services, and seeking methods of improving services.

Some experienced social workers from the United States serve in other parts of the world. They may work as consultants in the rehabilitation of the disabled, as teachers in schools or seminars, or as administrators in setting up agencies and schools. They may be employees of the Federal Government, the United Nations or one of its affiliated groups, national professional associations, or private agencies such as the American Red Cross, the Unitarian Service Committee, the Jewish Joint Distribution Committee, the Catholic Relief Service, and the Church World Service.

Training, Other Qualifications, and Advancement

Professional training is basically the same for all types of social work. Leaders in the field consider 2 years of graduate education desirable for all social workers and encourage employers and educators to adhere to this standard. However, because of the shortage of social workers in the face of continuing high demand for their services and the nature of the work, graduate training is not required for employment in a number of social welfare agencies.

In 1958, there were 55 schools of social work in the United States accredited by the Council on Social Work Education. In these schools, all of which are graduate schools, the student learns to perform social work functions through classroom courses, field work, and research. Time is divided about equally between classroom work covering all phases of social work and supervised field work in an agency selected by the school to meet the student's educational needs and vocational interests.

For admission to an accredited school of social work, an applicant must hold a bachelor's degree. Undergraduate courses suggested for the student planning to become a social worker include economics, political science, history, psychology, sociology, statistical methods, and the biological sciences. English composition, journalism, and public speaking courses help in preparing records, interviewing, working with the press, and participating in meetings and conferences. Preprofessional courses with social welfare content are offered by about 200 colleges and universities. About half of them are members of the Undergraduate Division of the Council on Social Work Education and have arranged at least 10 semester hours of these courses. Although such courses are not now required for entrance to graduate schools of social work, they provide an excellent introduction to this area of study and work.

Nearly 9,500 students were enrolled full or part time in graduate schools of social work in 1956–57; about 1,600 of them earned a master's degree that year.

More financial aid is available for graduate study in social work than in many other professions. In 1957, the total amount spent for social work scholarships and assistantships was estimated to approximate $4 million, with the average grant about $1,755 per student. Financial aid is given by graduate schools, private agencies, foundations, civic groups, and State Governments. As a result of the great need for qualified people, some agencies are willing to hire young people with a bachelor's degree immediately after graduation, have them work for awhile, and then grant educational leave and scholarships to those who have done satisfactory work. In other instances, agencies have set up work study plans in which students are offered scholarship aid in return for current services or agreement on future employment.

In addition to a bachelor's degree, students considering a career in social work should have an interest in people and in social problems, the initiative and perseverance needed for performing or obtaining social services, and an ability to organize work activities effectively. To enable them to promote good working relationships and encourage social adjustment in others, they should have a pleasant, easy manner in working with people, willingness to see other points of view objectively, and ability to use good judgment when dealing with problem situations. To help them find out whether they have the necessary personal qualifications, high school and college students are advised to serve as volunteer or part-time workers for the scouts or in settlement houses, hospitals, or camps. High school students old enough to qualify under labor laws in their State are sometimes hired as summertime helpers and assistants by some social agencies in several of the larger cities.

Opportunities for professional advancement are strongly influenced by the amount of education a social worker has obtained. For those with only a bachelor's degree who have been hired because of the shortage of professionally trained persons, promotional possibilities are limited without further training. In contrast, for those with graduate degrees who gain experience and demonstrate ability, there is a wide variety of opportunities in such higher level positions as senior staff member, supervisor, executive, teacher, and research worker. Moreover, while the demand for social workers exceeds the supply, advancement possibilities will continue to be very good for the well qualified.

Employment Outlook

In 1958, an estimated 12,000 vacancies existed in the social work field. Of these vacancies, about 4,000 were reported by settlement and community houses, Young Women's and Young Men's Christian Associations. About 3,000 vacancies were in public assistance and child welfare agencies, and more than 2,500 in medical and psychiatric social work. The Veterans Administration reported about 100 vacancies and the American Red Cross had 65 in its national office and others in local chapters. Teachers, supervisors, and administrators were also in short supply.

Not enough professionally qualified persons are entering the field to fill current vacancies, to replace persons who are retiring, to enlarge existing services, and to man new services. In view of the widespread gap between the number of graduates from schools of social work and the number needed, the shortage of social workers is expected to continue for 10 years or longer, regardless of the level of economic activity. The rising population and the growing interest in mental health, rehabilitation of the handicapped, prevention of juvenile delinquency, aid to older persons, and international assistance to peoples of other nations are all expected to create additional demand for social workers. It is also usually true that during periods of economic difficulties the demand for social workers is intensified.

As almost two-fifths of those graduating from schools of social work during 1956–57 were men, the number of men in the field is increasing gradually. Men hold significant proportions of the positions in the field of probation and parole, in group work, and in community organizations. Demand for their services is also good in administrative positions in all agencies, as clinical workers in the Veterans Administration and military hospitals, and in rehabilitation work.

Earnings and Working Conditions

Salaries of those entering or returning to social work after receiving a master's degree from a school of social work averaged $4,715 for men and $4,565 for women in the fall of 1957, according to a survey of the Council on Social Work Education. The highest salaries were reported by graduates engaged in public assistance and community organization work and the lowest salaries by those in family service work. These differences may be partly due to the fact that public welfare agencies frequently pay more than private agencies in the same area. Besides type of job and agency, other factors which affect wage variations include regional location, city size, and amount of education and previous experience an applicant has had.

In the Federal Civil Service in 1958, the entrance rate for persons with a master's degree from an accredited school of social work was $4,980 for those without work experience, and $5,985 for those with 2 years' experience. There was no Federal hiring in 1958 of college graduates who had undergraduate training in introductory social work courses but no subsequent social work training.

Considerable variation existed in the salary ranges established by each of the States for their health and welfare employees, according to a survey made by the U.S. Department of Health, Education, and Welfare in January 1958. The median minimum salary set for public assistance caseworkers with only a bachelor's degree was $3,360 and the median maximum salary was $4,320. For those with graduate education in social work, the comparable medians were $3,960 and $4,980 for public assistance workers; $4,008 and $5,124 for child welfare workers; and $4,560 and $5,700 for psychiatric social workers. Casework supervisors, usually required to have a master's degree in social work as well as casework experience, received comparable median salaries of $4,140 and $5,574 as public assistance supervisors and $4,560 and $5,760 as child welfare supervisors.

Community organizations generally pay starting salaries ranging from $5,500 to $6,000 a year to those with a graduate degree in social work and preferably with concentrated study and field work experience in community organization. After some years of experience in community organization work, salaries may range from $8,000 to $12,000 a year. For both public and private organizations, administrators with long experience and heavy responsibilities are paid higher salaries, some reported up to $35,000 a year.

The scheduled workweek for social workers is usually from 35 to 40 hours. Those working with community groups frequently have some nightwork. Social work positions generally provide such benefits as retirement pensions, paid sick leave, and vacations.

Where To Go for More Information

Information on accredited graduate schools of social work and available scholarships may be obtained from:

Council on Social Work Education,
345 East 46th St., New York 17, N.Y.

Information on employment practices may be obtained from:

National Association of Social Workers,
95 Madison Ave., New York 16, N.Y.

More detailed information on educational preparation and employment conditions is included in a series of eight bulletins on The Outlook for Women in Social Work (Bull. 235, series 1 to 8), which was published by the Women's Bureau in 1950–51 and is available in many libraries.

Statisticians

(D.O.T. 0–36.51)

Nature of Work

Many of the charts and graphs displayed in magazines and newspapers and on the walls of business offices illustrate the findings of studies planned by statisticians. These studies provide government and business officials with statistical information needed in making decisions. Statisticians use scientific methods to collect, analyze, and interpret numerical data for many purposes—for example, to forecast population growth, estimate the size of the corn crop, help determine the best design for a jet airplane, or measure the effectiveness of polio vaccine.

Some statisticians have the job of analyzing data already collected and preparing reports on their findings. Others must plan the collection of information through surveys or experiments. Statisticians engaged in survey work may choose the sources from which data can most readily be obtained, design a sample, draw up questionnaires or report forms, and prepare instructions for collecting the data. Statisticians who design experiments may prepare mathematical models which can be tested so that a particular theory may be confirmed or contradicted. In designing a survey or experiment, the statistician's principal task is to obtain sufficiently precise information on the subject being studied with the least possible expenditure of time and money. Regardless of the method used in obtaining the data, the statistician is expected to present his findings in summary tables, charts, and written reports.

Statisticians specialize, as a rule, either in mathematical statistics or in an applied field. Mathematical statisticians use mathematical techniques to design and improve statistical methods for handling data in any subject field. Applied statisticians use statistical methods to collect and analyze data about a particular subject field—for example, economics, psychology, public health, finance, or engineering. Mathematical and applied statisticians frequently work together in making statistical studies.

Many statisticians are engaged in research or perform administrative or supervisory functions in connection with research programs. Some are employed as college teachers—often combining teaching with research or administrative activities. Others act as consultants.

Because statistics is a tool which is used by specialists in a variety of fields, it is sometimes impossible to distinguish people who are primarily statisticians from those who are chiefly subject-matter specialists with a limited knowledge of statistics. For example, an applied statistician who provides quantitative information on economic conditions may have the title either of statistician or of economist. Similarly, some mathematical statisticians engaged in developing new statistical methods are classified as mathematicians. (See statement on Mathematicians, p. 130.) Furthermore, clerical workers who perform mathematical computations or prepare charts or tables are sometimes incorrectly called statisticians. This overlapping of fields makes it difficult to determine the number of statisticians. However, it is broadly estimated that, in 1958, there were between 15,000 and 20,000 professional workers whose major interest was in statistical methods and their application to problems in particular fields. A small but growing proportion of these workers are mathematical statisticians.

Where Employed

The largest employer of statisticians is the Federal Government. Every major Federal agency employs some members of this profession, although more than two-thirds of all statisticians on Federal payrolls are in the Departments of Defense, Commerce, and Agriculture. Private industry employs a large and growing number of statisticians, particularly in market research and quality control work. Colleges and universities are a major source of employment for mathematical statisticians. Other statisticians are employed by State and local governments, nonprofit foundations, and research organizations.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in mathematics or economics and a minor in statistics is the most usual educational requirement for an entry job leading to a professional position as a statistician. Only a limited number of colleges and universities offer a degree in statistics although the number is increasing. Essential courses in mathematics include college algebra, plane trigonometry, analytical geometry, and differential and integral calculus. In addition, at least one course in statistical methods is necessary. Advanced courses in mathematics and statistical theory are considered desirable for many jobs and essential for some. Furthermore, all statisticians not qualified as mathematical statisticians need thorough training in some subject-matter field.

Minimum requirements for an entrance position as a mathematical statistician in the Federal Government were, in early 1959, a bachelor's degree with 24 semester hours in mathematics and statistics, including at least 12 hours in mathematics and 6 hours in statistics. For entrance positions in other types of statistical work, the requirements were a bachelor's degree with 15 semester hours in statistics (or a combination of mathematics and statistics, including at least 6 hours in statistics) and 9 semester hours in the given subject-matter field; for example, in agriculture, health and medicine, engineering, or operations and administration including logistics, education, or physical science.

Many private firms have similar minimum prerequisites for entrance positions. In addition, for many quality control positions, statisticians need engineering training and courses in the application of statistical methods to manufacturing processes. For market research and forecasting work, a major in business administration or a related field is also helpful.

First jobs for inexperienced college graduates with only bachelor's degrees are likely to involve much clerical work. Since this work often requires the use of adding and calculating machines, ability to operate such machines is extremely helpful. In most types of employment, the statistician must also have considerable knowledge of tabulating equipment. Although persons with only bachelor's degrees may be able to advance to more responsible positions on the basis of experience, there is a trend toward requiring further academic training, especially in the subject-matter field, for advancement in analytical and survey work.

The master's degree in statistics or mathematics is required for many entry positions in mathematical statistics and is almost indispensable for promotion to high-level positions in this field. In many colleges and universities, this degree also qualifies the statistician for teaching in the department of mathematics. However, a doctor's degree is required for appointment as instructor in some high-ranking institutions and is essential for advancement to a professorship in many colleges. The doctorate is also an asset in obtaining high-ranking administrative positions and consulting work outside the college teaching field.

Employment Outlook

The demand for qualified statisticians is expected to increase substantially during the 1960 decade. The largest expansion in employment of statisticians is expected to occur in private industry, but moderate increases are likely in other types of employment as well. In addition, several hundred statisticians will be required yearly to replace those who resign, retire or die. Mathematical statisticians will have the best employment opportunities. Because of the growing emphasis on modern statistical methods in the conduct of research, the proportion of statisticians who are mathematically trained is likely to rise even in organizations which do not greatly increase their research staffs.

In private industry, persons with broad training in mathematics and statistics and a knowledge of engineering or physical sciences will be in demand to aid engineers in designing experiments and testing new equipment, and in production quality control work.

Companies are also expected to rely more and more on statisticians in analyzing and forecasting sales and business conditions, modernizing their accounting procedures, and solving other management problems. With the growing use of electronic computing machines, there will be an increasing demand for statisticians who are able to plan work so as to make the most efficient use of such equipment.

The number of teachers of statistics is also expected to rise, owing to increasing college enrollments (see statement on College and University Teachers, p. 47) and because many colleges are likely to offer more courses in statistics as the importance of statistical training in other fields of study becomes more widely recognized.

Employment of statisticians in government agencies is also likely to rise moderately. Additional personnel are expected to be needed to analyze data on the operations of expanded programs in such fields as social security, health, and education. Also, a large number of statisticians will continue to be employed in long-term programs involving collection and analysis of economic data of many kinds.

Earnings and Working Conditions

The average (median) salary of new graduates with the bachelor's degree who were employed in private industry as statisticians or junior economists was $354 a month in 1958 (according to a survey of graduates with a major in economics made by the Board of Examiners of the U.S. Bureau of the Census). New graduates with a master's degree earned, on the average, nearly $100 more a month.

Early in 1959, the beginning salary for mathematical statisticians in the Federal Government was $4,490 or $5,430 a year, depending on the individual's college record. Inexperienced mathematical statisticians with 1 year of graduate training were eligible to start at $5,430, and those with 2 years of graduate training at $6,285. Mathematical statisticians with a Ph. D. degree but no experience were eligible to start at $7,510. Beginning salaries of other types of statisticians were $4,040 to $4,980, depending on their college records. Those with 1 year of graduate training but no experience were eligible to start at $4,980; those with 2 years of graduate training at $5,985; and those with the Ph. D. degree at $7,030.

Statisticians earn more, on the average, than persons working in the closely related social science fields. A survey by the Bureau of Labor Statistics of the earnings of social scientists in 1952 indicated that the average (median) annual salary of statisticians was $6,800, somewhat higher than the average for economists ($6,500) and much higher than the comparable figures for other social science fields. Salaries of statisticians, like those of other professional workers, have risen substantially since 1952.

Where To Go for More Information

Additional information on employment trends and on educational requirements for statisticians specializing in social science fields is given in the following publication:

Employment Outlook in the Social Sciences. Bureau of Labor Statistics Bulletin 1167, 1954. Superintendent of Documents, Washington 25, D.C. Price 30 cents.

Clerical, Sales, and Service Occupations

CLERICAL OCCUPATIONS

Clerical workers have recently become the second largest of all the major occupational groups in the United States. (See p. 21 in introduction.) About one out of every seven persons at work in 1958 was in a clerical or closely related job. Altogether, slightly more than 9 million men and women were employed to take care of the vast amount of correspondence, recordkeeping, and other office duties necessary to the operation of modern businesses and government agencies.

Nature and Location of Clerical Work

The major clerical occupations are shown in chart 21. Stenographers, typists, and secretaries are by far the largest specialized group of clerical workers. Bookkeepers are the second largest group. Other large clerical occupations include those of telephone operator, shipping and receiving clerk, cashier, mail carrier, and office machine operator.

Many officeworkers are designated simply as "clerks." There are also large numbers with specific titles which indicate the type of work done—for example, file clerk, billing clerk, credit clerk, time clerk, payroll clerk, or postal clerk. These clerks and many others who were not classified separately by the Census made up more than one-third of all clerical employees in 1950.

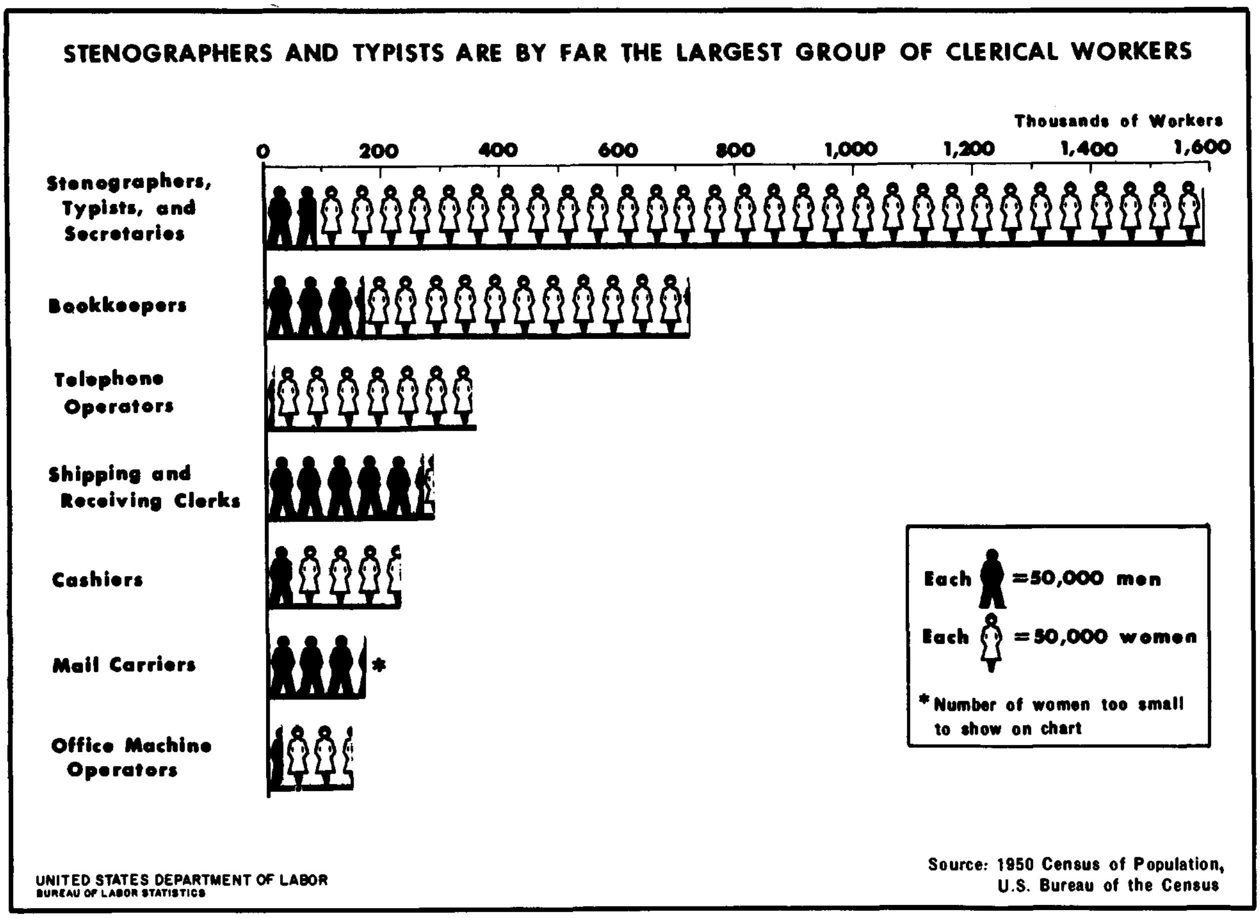
Clerical work is the largest of all areas of employment for women. In 1958, about 3 out of every 10 employed women were officeworkers. The number and proportion of women in clerical occupations have been rising steadily over the years. Women outnumbered men in these occupations for the first time in 1940, and by 1958, more than two-thirds of all clerical workers were women. More than 90 percent of the telephone operators; the stenographers, typists, and secretaries; and the attendants in physicians' and dentists' offices are women. Women also fill more than three-fourths of the jobs as bookkeepers, cashiers, and office machine operators. Only in one large occupation—office machine operator—was there a rise from 1940 to 1950 in the proportion of men employed. Nevertheless, about 3 million men were employed in clerical and related work in 1958. More men than women were working as shipping and receiving clerks, mail carriers, bank tellers, ticket agents, messengers, and telegraph operators, as well as in many smaller occupational groups such as vehicle dispatchers, bill collectors, railway mail clerks, and baggagemen.

Clerical workers are employed in all industries, since some officework is essential in nearly every

Clerical work is the largest of all areas of employment for women.

business. However, an increasing proportion of clerical workers are employed in finance, service, and related industries—principally in banks, in insurance and real estate companies, and in professional and business services. More than one-fourth of all officeworkers were employed in this group of industries in 1956, whereas only a little more than one-fifth of such workers were employed in manufacturing. Wholesale and retail trade, government, and transportation, communication, and other public utilities also employed large numbers of clerical workers.

CHART 21



Clerical jobs are to be found in the smallest of towns—everywhere that business is carried on. However, the great concentration of employment is in the largest cities where the central offices of insurance companies, banks, and corporations are located or where large government offices are established.

Training and Other Qualifications

Graduation from high school is the usual minimum educational requirement for entering clerical jobs. Additional business courses or some college work may be required for jobs requiring specialized skill. The most widely sought office skills—stenography and typewriting—may be obtained either through high school or business school courses. Ability to do some typewriting is an asset in qualifying for most types of clerical work. The operation of many kinds of office machines, such as adding machines, special bookkeeping machines, and billing machines, is often taught on the job. A good many large firms offer training courses in the use of equipment such as telephone switchboards, dictating machines, or electric typewriters, and a few firms finance business school training for employees on company time if they agree to stay on for a stated period of employment. Many companies participate in work-study programs with local high schools; pupils who have been in such programs usually are given preference when seeking employment. Some employers give aptitude and other tests to applicants for office jobs. Reading comprehension, numerical skill, and good knowledge of spelling and grammar are important in obtaining a job and essential to advancement. Ability to get along with others is also rated high among the qualifications necessary for success in office work.

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College graduates often enter clerical occupations to gain experience in a particular industry or business and later work up to professional or administrative positions. Young people who enter with little education may never advance far and may leave for other types of jobs. However, companies often prefer to hire people with only minimum qualifications for routine clerical positions, since they are more likely to be satisfied with and remain on these jobs than are persons with more advanced training.

Promotion from a beginning clerical job may be first to a minor supervisory position and then to that of section head. Many preferred jobs—secretary, information clerk, customer relations clerk, and others requiring a general knowledge of company policies and procedures—are frequently filled by promotion from within. Although seniority is an important consideration in selecting clerks for promotion and transfer, emphasis is also placed on the individual's ability and personal qualifications for the new job.

Employment Outlook

Large numbers of openings will occur each year in clerical occupations during the 1960's. Most of the employment opportunities will result from employee turnover, which is exceptionally high in this field. In several hundred firms with office staffs ranging from fewer than 50 to more than 1,000 workers, the average annual turnover rate was more than 25 percent, according to a survey made by a private organization in 1958. This high turnover results mainly from young women leaving their jobs to marry or care for their children.

In addition to the many jobs expected to become available because of continuing high replacement rates, a number of new opportunities will result from employment growth. However, the rate of growth is likely to be slower than in the past few decades.

A rapid rise in the number of clerical workers and in the proportion these workers represent of the total working force has been a marked feature in the growth of American industry over the years. (See chart 7, p. 20.) In 1910, only 1 in 20 American workers was engaged in clerical work. By 1940, the proportion of clerical workers had risen to 1 in 10 and, by 1950, to 1 in 8 employed workers. In 1958, it was still higher—about one in seven employed workers.

Underlying the growth in clerical occupations has been the tremendous increase in the size and complexity of business organizations, which has added greatly to the volume of recordkeeping and communciation required. Centralized management services have been established to aid in the control and coordination of these enlarged organizations, and this has brought about expansion in such areas as advertising, research, accounting, marketing, personnel administration, insurance and other employee benefits. These activities have added vastly to the amount of paperwork involved in business management. At the same time, the greater volume of tax and other reports to government agencies further increased the amount of officework required of industry, and has also greatly increased clerical work in government offices.

The remarkable overall increase in clerical employment has taken place despite the use of laborsaving equipment and more efficient management methods. However, the introduction of new office machines has had varying effects on employment in different types of clerical jobs. For example, the introduction of electric typewriters, duplicating equipment, machines to take dictation, and other improvements in methods of writing and copying letters and reports has failed to halt the rise in employment of secretaries, stenographers, and typists. On the other hand, the widespread use of teletype machines and the expansion of telephone services undoubtedly has played a major role in reducing the number of telegraph operators and telegraph messengers. Moreover, the growing use of bookkeeping machines has changed bookkeeping from a hand job to a largely machine operation.

In the future, clerical employment is likely to continue to rise owing to the same factors that have brought about previous increases. However, industry is making a determined attack on the problem of clerical costs and is introducing new equipment and methods designed to handle a rising volume of work without a corresponding increase in the number of workers required. The installation, by 1958, of more than 1,000 high-speed electronic computers in various industries and in government agencies had already reduced the need for certain types of clerical personnel.

The overall effect of the use of electronic data-processing systems is to displace many clerks in routine and repetitive jobs—such as sorting, filing, and operating small machines—and to create a few new higher skill and usually better paid jobs. Workers in jobs requiring the use of considerable judgment or contact with other people—secretaries, receptionists, claim clerks, complaint clerks, and bill collectors, to name a few—will be least affected by office mechanization and automation. Since the electronic systems are expensive and complicated, a company usually goes through a long period of investigation before making the decision to purchase the machines. Furthermore, considerable time usually elapses between the installation of the new machines and the final transfer of affected clerical operations. It is therefore uncertain when office automation will have the greatest impact on clerical employment, but the effects are not likely to be extensive for several years. Probably a more important factor affecting employment of clerical personnel in the 1960 decade will be the more widespread use of less expensive office equipment such as improved bookkeeping machines, calculators, adding machines, and photographic and other duplicating equipment.

Taking into account the basic growth factors in the clerical field and the efforts of business to reduce clerical costs by the use of more automatic equipment and other means, it appears likely that employment in clerical occupations will continue to increase but at a slower pace than during the past several decades. There is already some evidence of a slowing down. If the number of clerical workers had continued to rise as rapidly after 1950 as it did in the previous decade, the total number of clerical workers in 1958 would have been nearly a million greater than the actual total of somewhat more than 9 million.

Part of the increase in clerical employment in the 1960's will be in part-time jobs, as it has been during the past decade. Many of these jobs have been filled by older workers, high school age youth, housewives, handicapped workers, and others. Assuming that the general level of employment remains high, employers are likely to continue to recruit many clerical workers—both full- and part-time—from these groups.

Employment opportunities in the clerical field may be greatly affected by changes in the level of business activity. There are usually plenty of people in the labor force with the qualifications needed for most office jobs. However, the comparatively low salaries offered limit the number of applicants when other jobs are available. On the other hand, when business activity declines keen competition is likely to develop, since the supply of workers available for clerical employment is increased by displaced workers from many other occupations.

Earnings and Working Conditions

Women clerical workers in beginning jobs such as file clerk and office girl had average weekly salaries of about $45 to $55 in late 1957 and early 1958, in most of the 19 labor market areas surveyed by the Bureau of Labor Statistics. (See table.) The highest paid clerical workers were men accounting clerks (not shown in table) whose average weekly salaries ranged from $83.50 in Boston, Mass., to $102 in Cleveland, Ohio. Among women clerical workers, secretaries were generally the highest paid with average salaries ranging from $66 a week in Memphis, Tenn., to $89.50 in Cleveland, Ohio. (Additional information on the salaries of secretaries, stenographers, and typists and of bookkeepers and office machine operators is included in the separate statements in this chapter and in the chapter on Government Occupations. Salaries of telephone operators are discussed on p. 711 and salaries of railway clerks on p. 683.)

Average weekly salaries for clerical workers in Chicago, Cleveland, Los Angeles–Long Beach, and San Francisco–Oakland—the highest paying areas—were 5 to 6 percent above pay levels in the New York City area. Clerical workers' salaries in Milwaukee, Newark–Jersey City, Portland, and Seattle were very close to those in the New York area. Average salaries in New Orleans and Memphis were generally lower.

Pay levels for officeworkers tend to be higher in manufacturing than in most nonmanufacturing industries. However, salaries in public utilities frequently exceed those in manufacturing establishments.

Most officeworkers in the cities surveyed had a 5-day 40-hour week. In New York City, *Average Weekly Salaries for Women in 14 Office Occupations, 19 Areas, Winter 1957–58*

Area	Accounting clerks class A	Accounting clerks class B	Billing machine operators	Bookkeeping machine operators class A	Bookkeeping machine operators class B	Comptometer operators	Duplicating machine operators	File clerks class A	File clerks class B	Key punch operators	Office girls	Order clerks	Payroll clerks	Tabulating machine operators
Northeast:														
Boston	$68.50	$56.50	$61.50	$63.00	$55.50	$57.50	$53.50	$58.50	$47.00	$57.50	$47.50	$58.50	$63.00	$62.50
Newark-Jersey City	76.50	62.50	62.50	73.00	58.00	68.00	61.50	63.50	50.50	63.50	53.50	64.50	71.50	69.00
New York City	81.00	64.50	66.00	74.50	63.50	68.50	59.00	67.50	54.00	63.50	51.00	66.00	75.50	72.50
Philadelphia	72.50	57.50	61.00	67.00	56.50	62.00	55.00	61.50	47.50	60.00	46.50	53.50	65.00	65.50
South:														
Atlanta	74.50	57.00	58.00	63.00	59.00	62.50	53.00	60.00	47.50	60.00	48.00	56.00	64.50	63.00
Baltimore	70.50	58.00	58.00	65.50	51.50	63.50	56.50	57.50	46.00	58.50	46.00	53.50	66.00	65.00
Dallas	70.00	59.50	60.50	66.50	55.00	61.50	61.00	58.00	47.00	59.00	46.50	58.50	64.50	68.00
Memphis	67.50	54.50	55.00	68.00	52.50	54.50	--------	56.00	46.50	58.50	45.50	55.50	59.50	68.50
New Orleans	74.00	56.00	53.00	62.00	52.50	58.00	--------	59.00	45.50	58.50	40.50	56.50	59.00	71.00
North Central:														
Chicago	84.00	68.00	68.50	80.50	68.00	72.00	63.50	68.00	55.50	69.50	56.50	68.00	76.50	77.00
Cleveland	81.50	69.00	66.50	79.00	64.50	71.50	67.50	69.00	57.00	71.50	57.50	68.00	76.00	77.00
Milwaukee	81.00	62.50	56.00	73.50	60.00	61.00	61.00	64.50	56.00	63.00	50.00	63.50	67.00	72.50
Minneapolis-St. Paul	73.00	57.50	55.50	69.00	56.50	62.50	53.50	59.50	48.50	56.00	46.50	59.00	65.50	67.50
St. Louis	77.00	58.50	61.50	64.50	56.00	63.50	57.50	61.00	50.50	62.50	50.50	59.00	65.00	74.50
West:														
Denver	72.00	60.00	61.00	71.00	56.00	60.50	56.50	61.50	52.50	59.50	47.50	56.00	67.00	70.50
Los Angeles-Long Beach	84.00	70.00	67.00	81.50	62.00	76.00	66.50	67.50	55.00	74.00	57.50	75.50	78.50	85.50
Portland	79.00	67.00	63.00	76.00	59.50	67.00	61.00	63.50	49.50	67.00	49.00	63.50	70.50	82.00
San Francisco-Oakland	79.50	68.50	74.50	81.00	60.50	72.00	66.00	71.50	55.00	68.00	57.50	76.00	80.50	80.50
Seattle	74.00	62.50	60.50	72.50	58.00	66.00	54.50	67.50	54.50	65.50	55.50	65.50	71.00	73.50

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics.

however, 9 out of 10 officeworkers had a workweek of less than 40 hours—most typically 35 hours.

Officeworkers usually receive at least 6 paid holidays a year and 2 weeks paid vacation after a year's employment. Related benefits usually include life insurance, hospitalization and surgical insurance, pay continuation in case of accident or illness, and some type of retirement pension plan.

Where To Go for More Information

Information on clerical workers in different fields of employment is given in the chapters on various industries—especially those on the banking, insurance, and telephone industries—and in the chapter on Government Occupations. (See index.)

A discussion of the effect of electronic computers on employment of clerical workers is contained in the following publication:

Automation and Employment Opportunities for Officeworkers, Bureau of Labor Statistics, Bulletin 1241, 1958. Superintendent of Documents, Washington 25, D.C. Price 15 cents.

Information on training is available from:

United Business Education Association (A department of the National Education Association),
1201 16th St. NW., Washington 6, D.C.

Information on private business schools may be obtained from:

National Association and Council of Business Schools,
2400 16th St. NW., Washington 9, D.C.

Bookkeepers

(D.O.T. 1–01.00 through .49 and 1–02)

Nature of Work

Bookkeepers used to be pictured sitting on high stools making entries in huge ledgers. They were recording all the details of their employers' business transactions, in order to prepare balance sheets, profit and loss statements and other reports. Bookkeepers still perform these record-

Bookkeeping machine operator making entries in a ledger.

keeping functions. Nowadays, however, many of them are employed as bookkeeping machine operators rather than as hand bookkeepers.

In large offices, bookkeeping jobs range from entry positions as clerk or machine operator to the highly responsible post of head bookkeeper. Bookkeepers or accounting clerks in entry type jobs perform routine tasks such as posting items by hand in accounts payable ledgers, entering vouchers in special registers, or recording other data on accounting forms. They may also check or add up accounts (take trial balances) on an adding machine. Bookkeeping machine operators may use relatively simple bookkeeping machines to record only one type of data or may operate complicated machines that record a great variety of items. Bookkeepers in jobs with greater responsibility may also post and balance accounts and, in addition, do more difficult work such as preparing summary reports. In establishments with a large volume of business, a bookkeeper or machine operator may work on only one section of the records, for example, accounts receivable or raw material purchases. The head bookkeeper has responsibility for all aspects of his department's work.

General bookkeepers, who are employed chiefly in small establishments, keep complete and systematic records—making entries in journals and on special forms, posting ledgers, balancing books and compiling reports. In small offices, bookkeepers may also have other duties including typing, filing, answering the telephone, and mailing statements to customers.

Where Employed

About 900,000 workers were employed as bookkeepers in 1958; more than three-fourths of them were women. Well over one-third of all bookkeepers are employed by retail stores or wholesale houses, one-fifth by manufacturing firms, and about one-sixth by finance, insurance, and real estate firms. (For information on bookkeepers in banks see chapter on Banking Occupations, p. 523.) Substantial numbers are employed also by public utility companies, business and professional services, and construction companies.

Training and Other Qualifications

Most employers hire only applicants who are graduates of high schools, business or vocational schools or, in some instances, of junior colleges. A business course which includes training in typing, shorthand, and the use of office machines, as well as in business arithmetic and bookkeeping procedures, is often especially helpful in obtaining a bookkeeping job. An increasing number of large companies offer some on-the-job training or participate in cooperative school-and-work programs, under which students obtain school credit for part-time work. Experience of this kind is very helpful in obtaining full-time employment after graduation. For advancement to a position as head bookkeeper it is usually necessary to have education in accounting or extensive bookkeeping experience.

General bookkeepers should have above average aptitude for numbers and the ability to concentrate on details. Bookkeeping machine operators need finger dexterity and good coordination of eye and hand movements.

Employment Outlook

Many employment opportunities for bookkeepers are expected during the early 1960's. In this large occupation, with its high proportion of women, the rate of employee turnover is very great. There is constant demand for new employees to replace young women who leave after a few years of employment to marry or to take care of their families. In addition, a moderate number of new jobs will become available as the field continues to expand. However, the trend toward breaking down bookkeeping functions into bookkeeping machine operator and other routine clerical jobs is likely to continue, and the vast majority of openings will be in such jobs. Employment opportunities for bookkeepers who are qualified to assume responsibility for a complete set of books will probably continue to be good, although such jobs will be relatively few in number and will generally be filled by promotion from within or by persons with accounting training or experience. The great majority of openings for hand bookkeepers will be in small offices.

Over the long run, the growth in the number of bookkeepers is likely to be slowed down markedly by the increasing use of office machines. The more extensive use of bookkeeping machines and related equipment in small firms and the further introduction of electronic computers in large offices will make possible a great increase in the amount of work performed, without a corresponding increase in the number of bookkeepers. Nevertheless, some new jobs for bookkeepers will arise each year because of such factors as the growing emphasis on scientific management in industry, increasingly complex tax systems, and the general growth of the economy. (See also the statement on Accountants, page 179.)

Earnings and Working Conditions

Average weekly salaries of women bookkeepers or accounting clerks in beginning type (class B) jobs ranged from about $55 to $70 in 19 cities surveyed in 1957–58 by the U.S. Department of Labor's Bureau of Labor Statistics. (See table on p. 228.) Bookkeeping machine operators (class B) had somewhat lower average weekly salaries, ranging from about $52 to $68. Women accounting clerks who did work usually requiring experience (class A) received the highest weekly pay among the women's bookkeeping jobs surveyed—averaging from about $68 in Memphis to $84 in Chicago and the Los Angeles–Long Beach area. Women bookkeeping machine operators (class A) averaged from $62 to $82 a week depending on geographic location.

Men earned substantially more than women in each of the cities included in the survey. Average weekly salaries of men in the highest rated accounting clerk jobs (class A) ranged from about $84 in Boston to $102 in Cleveland; average weekly salaries of men accounting clerks in class B jobs ranged from $62 in Boston to $85 in Seattle.

Bookkeepers generally work about 35 to 40 hours a week, depending on the industry. Most of them receive at least 6 paid holidays a year and 2 weeks' paid vacation after a year's employment. Like most other officeworkers, they generally continue to receive pay during short periods of illness and they are usually covered by life insurance, pension, hospital, surgical and other employee benefit plans. Most bookkeeping jobs do not require strenuous physical exertion and can be performed by people with certain types of physical handicaps.

Where To Go for More Information

Information on training for bookkeeping jobs is available from:

United Business Education Association (A Department of the National Education Association),
1201 16th St. NW., Washington 6, D.C.

Information about private business schools may be obtained from:

National Association and Council of Business Schools,
2400 16th St. NW., Washington 9, D.C.

Office Machine Operators

(D.O.T. 1–25.)

Nature of Work

Modern businesses use a wide variety of office machines to help speed up the handling of records, reports, and other paperwork. The clerks who operate these machines usually have job titles which identify them with the types of machines they operate—for example, adding machine operator, calculating machine operator, billing machine operator, or keypunch operator.

The machines used in large offices may range from simple mechanical letter openers to complex electronic computers, and the nature of the operators' work depends on the type of equipment used. In the operation of some machines—billing, adding, and calculating machines—workers repeatedly press the numbered or lettered keys on the keyboard. Other machines—duplicating, mailing, and tabulating machines—run automatically for long periods once they are set in motion by operators who push the control buttons or switches. However, regardless of the equipment used, most office machine operator jobs are of a routine nature. Operators are usually assigned a specific repetitive job to do on one type of machine. For example, an addressing machine operator may spend most or all of his time running the machine that prints on envelopes the names and addresses of his employer's customers. However, an operator is sometimes given more varied assignments as in the case of a calculating machine operator who may compute percentages or averages or make other statistical computations.

Billing machine operators (D.O.T. 1–25.00 through .09) make up one of the largest groups of operators of mechanical office equipment. These workers prepare customers' bills, statements, and invoices. By striking lettered and numbered keys, the operators transcribe information such as the customer's name, address, and the items purchased or services given. They then press keys to record amounts of money involved and the machine prints totals, net amounts, discounts, or other items. A company may have its billing operation broken down so that each machine operator handles certain types of accounts—for example, those of customers whose accounts are current.

Adding machine operators (D.O.T. 1–25.12) use electric or, in a few offices, lever-operated machines to add and subtract and sometimes multiply groups of numbers. *Calculating machine* or *Comptometer operators* (D.O.T. 1–25.13) use machines more complex than adding machines to make various computations in connection with financial accounts, payrolls, invoices, and numerous other business or statistical operations.

Mailing machine operators (D.O.T. 1–25.40 through .49) run automatic mailing machines which address, fold, seal, and even stamp mail. The plates which are often used to address envelopes, newspapers, and other items run through the mailing machines are prepared by graphotype machine operators. These workers customarily use a machine similar to a typewriter which makes raised letters and numbers on address plates.

Duplicating machine operators (D.O.T. 1–25.20 through .29) reproduce many copies of typewritten or other material such as reports, advertising circulars, price lists, or speeches. The operator's main job is to set and adjust the machine, insert and remove papers, stencils, or other materials, and see that the machine works properly. For example, the operator of a Mimeograph machine (duplicating) inserts a stencil prepared by a typist, sets the cylinder speed, starts the machine, watches to see that the copy is clear and that the stencil does not tear, and removes batches of printed work. He may stop the machine and replace the ink pad, adjust the ink flow, or make other minor adjustments.

Operators of tabulating machines and related equipment (D.O.T. 1–25.60 through .69) handle large quantities of punchcards in connection with the automatic processing of accounting and statistical information. To prepare the information so that it can be used in tabulating or electronic computing machine systems, *keypunch operators* use machines similar to the typewriter to punch

Console operator is a new occupation related to the use of electronic computers.

a series of holes in cards. The cards are arranged in the proper sequence with automatic machines run by *sorting machine operators. Tabulating machine operators* insert the cards in machines which automatically analyze and translate the information punched in groups of cards, and finally print summary results on accounting records and other forms.

A small but fast growing group of office machine operators tend the new machines which are a part of complex high-speed electronic computing systems. The job of the *console operator* (D.O.T. 1–25.17) is to follow instruction sheets and push control buttons on a central computer in order to process punchcards or magnetic tapes. He must watch his control panel for flashing lights which indicate that trouble has developed and decide what steps must be taken to make the machines work properly. *Card-tape converter operators* (D.O.T. 1–25.60) tend machines which transfer data from punchcards to tapes or vice-versa, and *high-speed printer operators* (D.O.T. 1–25.98) run the machines that print the final results.

Many clerks occasionally operate office machines in connection with other types of jobs, but these workers are not covered by this statement, nor are typists, stenographers, or bookkeeping machine operators. (See separate statements in this chapter.)

Where Employed

It was estimated that well over 200,000 office machine operators—approximately 80 percent of them women—were employed in 1958. Most of them worked in the large cities where central or regional headquarters of big businesses and large government offices are located.

Some office machine operators are employed in nearly every industry. Almost a third of them work for manufacturing companies, and about a fifth for wholesale and retail firms. Large numbers are also employed in banks, insurance companies, and in government agencies. (See chapters on Banking and Insurance Occupations.)

Training and Other Qualifications

Graduation from high school or business school is required for many office machine operator jobs. Courses in the operation of office machines are helpful, and business arithmetic is valuable for the many jobs involving work with figures. A particularly helpful type of preparation is given in combined work and study programs offered in many local school systems; taking this type of program helps young people decide if they like the kind of work involved and gives them valuable part-time experience. Job applicants with some college education are frequently given preference for positions as console operators of electronic computers.

As a rule, employers give their new employees on-the-job training for office machine operator jobs. The length of training varies from a week or so to several months, depending on the type of office machine. Only a few days are usually required to train operators of Mimeograph or mail-handling machines, for example. It may take a few weeks to give keypunch and calculating machine operators basic training, after which they practice on the job in order to increase their speed. Generally, it takes several weeks to train operators of tabulating machines; instruction is given on how to set and adjust these machines; in addition, some operators learn how to do simple wiring of plugboards. Since the new electronic computing equipment is even more complex than tabulating equipment, a somewhat longer training period is often required for operators of card-to-tape converters, high-speed printers, and other related machines. Moreover, console operators of electronic computers need some basic training in programming work (preparing instructions for the machine to follow), since this knowledge helps in getting the machine to operate properly when trouble develops. (See statement on Programmers, p. 208.) Operators of tabulating and electronic computing equipment are often trained at company expense in special schools established by equipment manufacturers.

Finger dexterity and good coordination of eye and hand movements are important for most office machine operator jobs. The ability to detect obvious errors in arithmetic computations is helpful to billing and calculating machine operators. Some mechanical ability is advantageous, especially to duplicating and tabulating machine operators.

Most employers follow a promotion-from-within policy, taking into consideration seniority and on-the-job performance based on the supervisor's ratings and recommendations. Promotion may be from a beginning routine job to that of a fullfledged machine operator who can handle varied assignments and who may help train beginners and check their work for accuracy; advancement may then be to a minor supervisory position and later to section head. Sometimes, employees are advanced by transferring them to the operation of a more complex machine—for example, from a tabulating machine to an electronic computing machine.

Employment Outlook

Many job openings for office machine operators are expected during the early 1960's. Employers in private industry and government will continue to hire a growing number of office machine operators, as businesses grow bigger and more complex and the volume of recordkeeping, computing, duplicating, mailing, and other work that can be done by machines continues to mount.

The introduction of new and improved machines of the same general types, now used in large numbers to speed up the processing of paperwork, will also tend to expand employment of office machine operators. Although some employers will install the newer and larger types of electronic machines, there is little evidence that the use of such equipment will cause much displacement of operators of smaller machines in the near future. The large machines used in office automation are expensive, and even big companies spend several months carefully weighing their advantages. After the equipment is ordered, a great deal of time usually passes before actual installation. Furthermore, most companies spend several months—sometimes a year or more—in so-called "parallel" operations; that is, during the period of transition the regular staff of office machine operators performs the same or a part of the operation that is also being run on the computer. The number of service centers which use machines (including electronic computers) to do officework—such as sorting, mailing, and preparing payrolls—on a fee basis is expected to increase. This development will probably add to the number employed in office machine operator jobs, since these service centers will be used by many small businesses which normally would not employ full-time operators.

Over the long run, it is expected that an increasing amount of clerical work will be taken over by large computers and other machines in electronic data processing systems. Furthermore, smaller and less expensive types of electronic computers are expected to be used in a growing number of establishments that cannot afford the large computers. Other new office machines will probably become available and be used along with computers to speed up recording, copying, and other aspects of officework.

The net effect of these developments will be a slower growth in employment of office machine operators over the long run. At the same time, the character of many jobs will change. For example, billing machine operators in big companies may be largely replaced by programmers and operators of electronic computing machines. The demand for workers in jobs related to office automation systems will continue to grow. Many of the new office machine operator jobs will be better paid and will require persons with higher levels of skill and training than the jobs they replace. Furthermore, many job opportunities for office machine operators will continue to arise from turnover, owing to the large numbers of young women in this field who stop working to marry or to take care of children.

Earnings and Working Conditions

Average weekly salaries ranged from about \$53 to \$85 for women in 5 office machine operator occupations, according to a 1957–58 survey by the Bureau of Labor Statistics in 19 large metropolitan areas. (See table on page 228.) Keypunch, billing machine and calculating machine (Comptometer) operators received weekly salaries averaging from about \$58 to \$68 in most of the areas. Among the occupations surveyed, duplicating (Mimeograph or Ditto) machine operators generally received the lowest weekly salaries—from about \$53 to \$63—and tabulating machine operators had the highest earnings—between approximately \$65 and \$85. Operators of the new electronic computers and auxiliary (peripheral) equipment generally receive salaries above those of tabulating machine operators.

Earnings of operators of most types of machines may differ greatly by geographical location; for example, women keypunch operators averaged about $57 a week in Boston and $74 in the Los Angeles–Long Beach area in late 1957 or early 1958. Men tabulating machine operators received weekly salaries averaging about $71 a week in Boston and $97 a week in Cleveland.

The standard workweek for office machine operators is usually 35 to 40 hours, depending on the industry. Some office machine operators work late shifts; for example, operators of electronic computing systems—those at the computer console or operators of the machines that convert and print information—may work a 4 p.m. to midnight shift or a midnight to 8 a.m. shift.

Operators of most office machines must be able to adapt themselves to routine and repetitive work and to the noise made by their machines. Operators of machines such as keypunch, calculating, and billing machines are seated at desks most of the day, while operators of duplicating and tabulating machines and those operating electronic equipment may have to stand for long periods.

Office machine operators usually receive at least 6 paid holidays a year and 2 weeks' paid vacation after a year's employment. They are usually covered by life insurance, pension, hospital, surgical and other employee benefit plans.

Where To Go for More Information

Information on office machine operators is also given in the chapters on banking, insurance, and other industries. (See index.)

Information on training is available from:

United Business Education Association (A Department of the National Education Association).
1201 16th St. NW., Washington 6, D.C.

Information about private business schools may be obtained from:

National Association and Council of Business Schools,
2400 16th St. NW., Washington 9, D.C.

The following publications by the U.S. Department of Labor give information on operators of electronic data-processing equipment:

Automation and Employment Opportunities for Officeworkers. Bureau of Labor Statistics Bulletin 1241, 1958, Superintendent of Documents, Washington 25, D.C., Price 15 cents.

Occupations in Electronic Data-Processing Systems. Bureau of Employment Security, 1959, Superintendent of Documents, Washington 25, D.C., Price 25 cents.

Secretaries, Stenographers, and Typists*

Nature of Work

Occupations requiring typing or stenographic skills and in which employees are usually designated as typist, stenographer, or secretary employed approximately 2¼ million persons in 1958, more than 95 percent of whom were women. Duties as well as job titles of people in occupations requiring these skills vary according to the requirements and specialties of individual businesses and offices, but for all employed on these jobs, typing is a common work factor.

Typists (D.O.T. 1–37.32) spend a major portion of their time in typing copies of printed or written materials. Junior, or class B, typists usually type fairly simple copy, such as routine forms from relatively clear handwritten or typed drafts. They may set up simple standard tables or copy more complex tables already properly spaced. Senior, or class A, typists copy material in final form from "rough" or involved drafts requiring ability to understand technical terms, abbreviations, and printer's symbols and to rearrange or combine materials from various sources. They may have to plan and type complicated statistical tables.

Either manual or electric typewriters may be used. An increasing number of offices furnish electric typewriters for their employees. Some have installed electric typewriters equipped with special keyboards for transcribing coded program instructions for electronic data-processing operations.

Many typists also perform such other clerical duties as filing, answering telephones, checking and proofreading copy, recording information in longhand, sorting mail, and operating calculators, tabulators, and duplicating or other office machines.

*Prepared by the Women's Bureau, U.S. Department of Labor.

Stenographers (D.O.T. 1–37.12), besides typing, take dictation from one or more persons, either in shorthand or by stenotype or similar machine (stenographers operating these machines are usually called *stenotype operators* (D.O.T. 1–37.14), and transcribe this dictation on a typewriter. An increasing number of stenographers, as well as secretaries and typists, do some transcription of dictation from sound-producing records. Where this is a primary duty, transcribing-machine operators are usually employed.

Many stenographers also compile and type reports, answer telephones, and operate switchboards; many operate various office machines and perform other clerical duties. Stenographers may be classified as junior or senior stenographers, depending upon their experience and the amount of supervision they receive. They may be classified as technical stenographers if the subject matter usually dictated involves science, medicine, law, or other specialized fields. A few stenographers become specialists in foreign languages, police work, or public or court stenography.

Court reporters (D.O.T. 1–37.18) who make verbatim reports of proceedings in a court of law, and conference reporters or other specialized shorthand reporters must be able to record accurately difficult technical language at high rates of speed, sometimes from many speakers, and for several hours at a time. Some of this type of reporting is done by means of microphone equipment attached to a recording or dictating machine. The reporter identifies the speakers and reports what is heard (edited and punctuated) into a soundproof, mask-shaped microphone, and the words are picked up by an attached recording or dictating machine.

Secretaries (D.O.T. 1–33) also have stenographic duties, but, in addition, they usually handle many business details for their employers on their own initiative, such as acknowledging correspondence, scheduling appointments and meetings, and obtaining a variety of information. Many serve as representatives of their employers, relieving them of numerous routine duties and of clerical supervision. They attend to correspondence and records of a private or confidential nature and may also handle some details of the employer's personal and social life.

The amount of responsibility involved in a specific job depends to a large extent upon the position of the executive for whom the secretary works. Private secretaries usually work for key executives or for professional persons and have more varied work assignments than secretary-stenographers and junior secretaries who usually work for lesser executives. Secretaries who advance to the rank of executive secretaries act as administrative assistants to top executives and often are given authority for making certain decisions, for planning office routine, and for public relations work. They often answer correspondence and supervise the typist-clerical staff.

Some secretaries specialize in legal, medical, engineering, or other types of secretarial work. Legal secretaries take dictation of more than ordinary difficulty and prepare various legal papers such as summonses, complaints, motions, and subpoenas. Medical secretaries take dictation of letters and reports and other material involving medical terminology and sometimes combine secretarial duties with routine laboratory and other semitechnical medical duties; they may type case histories and work with insurance claims. Engineering secretaries take dictation related to such fields as civil, electrical, chemical, mechanical, and aeronautical engineering and sometimes are expected to read blueprints.

Where Employed

Typists, stenographers, and secretaries are employed by practically every kind of business and industry as well as by Federal, State, and local governments and religious, civic, and social organizations. A majority of persons in these occupations work for private employers, but a considerable number are employed by government. Relatively few are self-employed.

These workers are found in small and large establishments, wherever there are offices. Legal stenographers and secretaries, for instance, work for practicing lawyers in small offices or large law firms, in government agencies, banks, insurance companies, large business corporations, unions, trade associations, building and loan associations, real estate offices, and many other types of offices. Medical secretaries work in small private offices of physicians, surgeons, or dentists, as well as in large establishments, including hospitals and clinics, medical schools, manufacturers of medical supplies, public health agencies, organizations dealing with prepaid medical care and hospitalization insurance, and by some drug and medicine manufacturers.

Training, Other Qualifications, and Advancement

Adequate performance in all three occupations depends upon typing skills and knowledge of spelling, vocabulary, punctuation, grammar, and correspondence procedures. Ability to use office equipment such as voice recorders, calculators, or tabulators is helpful for many jobs. Persons interested in becoming stenographers and secretaries must also be able to take and transcribe dictation. Stenographic and typing skill requirements vary somewhat according to employment demands of a community and according to particular employers, but the average working speeds shown in the following table are generally acceptable:

Class of worker	Words per minute		
	Dictation	Transcription	Typing
General typist			40–55
Technical typist			50–65
Transcribing-machine typist			45–65
Junior stenographer	80–100	25–35	40–50
Senior stenographer	100–140	35–40	50–60
Court reporter	150 or more	55–65	70–80

Graduation from high school is practically essential. Completion of a high school business course often satisfies basic skill requirements for typists and beginning stenographer positions; however, on-the-job experience or additional education in business subjects such as business law and office procedures is necessary for many stenographic and secretarial positions. Many positions require a knowledge of the terminology of a particular field, such as medicine, law, or engineering, or the ability to use a foreign language. A broad general background of education is of considerable value for initial placement in many positions as well as for promotion.

There are many possibilities for post high school training. For the high school graduate who accepts employment and wants to acquire additional skills or further general education, night school courses are available. A few employers and manufacturers also provide training in office skills. Many private business schools, colleges, and universities offer training in both daytime and evening classes. Bachelor degrees were offered in the field of secretarial studies by the schools of business and commerce in 217 colleges and universities in 1956–57. One university offered a master's degree. Many other colleges and universities offer 1- to 3-year curriculums preparing students for general, legal, technical, and medical-dental secretarial work. Some 1,400 private business schools offer business courses of varying length and cost, and many include courses in special terminology and office practice as well as in psychology, personality development, and human relations. A growing number of schools provide training in new aspects of office automation.

Personal qualifications necessary for these jobs include manual and finger dexterity, good vision, promptness, neatness, and a friendly manner. Where meeting the public is involved, an attractive personal appearance is often specified by employers. For more responsible positions, discretion, good judgment, and initiative are also important.

Typists, stenographers, and secretaries with ability have good possibilities for advancement to higher level positions. The typist may become an expert operator of one or more office machines that require special skill or, with training in shorthand, may advance to a stenographic position. Stenographers may advance to positions as secretaries, operators of one or more special machines, administrative assistants, or office supervisors. A secretary can become an executive secretary or an administrative assistant or fill other highly responsible positions requiring specialized knowledge of the particular industry or business in which she is employed. Advancement also may come in the form of greater responsibilities and higher salary without any change in job title.

Employment Outlook

Many thousands of openings for typists, stenographers, and secretaries will be available each year. Many of the young women now employed in these occupations are expected to leave the labor market to assume family responsibilities, and new opportunities will be created by expanded business and government activities and the anticipated increasing number of jobs in finance, trade, and service industries.

A shortage of employees in these occupations has existed in many areas since World War II because of the relatively steady rise in the Nation's economic activity, the increased amount of recordkeeping and correspondence required, and the creation of additional jobs at a time when the number of persons available for such work had declined.

Some easing of the shortage was experienced in 1958, along with the general slowdown in business activity. However, competition for employees in these occupations continued keen in some areas, particularly for well qualified persons and for those with multiple office skills.

It is anticipated that through the 1960's employment will rise as the economy expands further and office activities increase in complexity. Technological developments are not expected to lessen materially the demand for persons in these occupations. Work requirements, however, may change to some extent with the introduction of new office machinery and procedures. Turnover rates will probably remain high, with rates for typists and general stenographers higher than for stenographers in special fields, secretaries, and court reporters. Stenographers and secretaries are expected to continue to have a wider choice of jobs than persons with typing skills only.

Positions requiring stenographic and typing skills generally offer steady employment, unless there is a major decline in economic activity.

Earnings and Working Conditions

Salaries paid typists, stenographers, and secretaries are greatly influenced by the location of the job, the size and type of the business, the responsibility or skill level required, the length of the workweek, and the qualifications of the individual employee.

Average weekly salaries of women typists, stenographers, and secretaries in private industry, according to a 1957–58 survey by the Bureau of Labor Statistics of officeworkers in 19 metropolitan areas, are shown below.

Metropolitan area	Secretary	Stenographer[1]		Typist[2]	
		General	Technical	Class A	Class B
Atlanta, Ga	$77.50	$65.50	------	$59.50	$50.00
Baltimore, Md	76.00	64.00	------	64.00	51.50
Boston, Mass	71.50	61.50	$64.00	58.50	51.00
Chicago, Ill	87.00	64.00	83.50	71.00	61.00
Cleveland, Ohio	89.50	74.00	82.50	73.00	62.50
Dallas, Tex	77.00	66.50	83.00	59.00	51.00
Denver, Colo	79.00	66.50	77.00	59.50	53.00
Los Angeles-Long Beach, Calif	87.00	75.00	84.50	70.50	60.50
Memphis, Tenn	66.00	58.50	------	58.00	46.50
Milwaukee, Wis	83.50	66.50	------	77.00	56.50
Minneapolis-St. Paul, Minn	74.00	62.00	64.00	59.00	52.00
Newark-Jersey City, N.J	83.00	67.50	72.50	65.00	55.50
New Orleans, La	76.50	62.00	------	56.00	50.00
New York, N.Y	85.00	69.00	82.00	66.00	58.50
Philadelphia, Pa	78.00	64.50	72.50	62.50	52.50
Portland, Oreg	80.50	69.00	------	64.50	56.50
St. Louis, Mo	79.00	63.50	69.50	62.50	53.50
San Francisco-Oakland, Calif	85.00	74.00	72.50	70.50	59.50
Seattle, Wash	82.00	69.50	71.50	65.00	54.50

[1] Dictation received by Stenographer, General, involves a normal routine vocabulary and that received by Stenographer, Technical, involves a varied technical or specialized vocabulary such as in legal briefs or reports on scientific research.

[2] Class B involves typing from relatively clear or typed drafts and setting up simple standard tabulations, or copying more complex ones, and Class A, typing of very rough or complicated material and setting up and typing complicated statistical tables.

Average salaries paid transcribing-machine operators, whose primary duty is transcribing dictation involving normal routine vocabulary from sound-producing records, were in most cities between those of Class A and Class B typists.

In the Federal civil service, practically all typists are classified in positions for which the annual salaries range from $3,255 to $4,065. Almost as large a proportion of stenographers, including clerk-stenographers, are in positions for which the range is $3,495 to $4,325. Approximately 90 percent of the secretaries are in positions paying from $3,755 to $5,390, and 85 percent of the specialized shorthand reporters receive from $4,490 to $5,880.

Hours of work are regular, and a 5-day workweek is common. A workweek of less than

40 hours is customary in many offices in private industry. However, private and executive secretaries are somtimes required to work longer than the normal workday. In 18 of the 19 metropolitan areas covered by the 1957–58 Bureau of Labor Statistics survey, typists, stenographers, and secretaries worked an average of 38 to 40 hours a week; in one area, the average was 36 hours.

Two weeks' paid vacation each year after the first year of service is usual in private industry. Almost three-fourths of the workers in most of the areas surveyed were provided 3 weeks of paid vacation after 15 years of service.

Officeworkers also receive a number of holidays with pay. National holidays are usually granted, and some workers are given State and local holidays as well.

Group insurance is available in many private firms and industries. In some firms, the premium cost is paid by employers; in some, by employees; and in others, the cost is shared. Insurance coverage may include sickness and accident, hospitalization, life, or a combination of these.

Private retirement or pension plans, supplementing the Federal Government social security program, are also becoming more common in industry. In the 1957–58 survey, from 57 percent to 87 percent of all workers in 17 of the 19 major metropolitan areas surveyed were employed in firms with retirement or pension plans at least partially paid for by employers. (For earnings and working conditions of secretaries, stenographers, and typists in Government, see chapter on Government Occupations.)

Where To Go for More Information

The following publication provides additional information about these and other clerical occupations, including references to other sources:

Employment Opportunities for Women as Secretaries, Stenographers, Typists, and as Office Machine Operators and Cashiers. Women's Bureau Bulletin 263, 1957. Superintendent of Documents, Washington 25, D.C. Price 20 cents.

See also introductory statement to Clerical Occupations for other sources of information.

SALES OCCUPATIONS

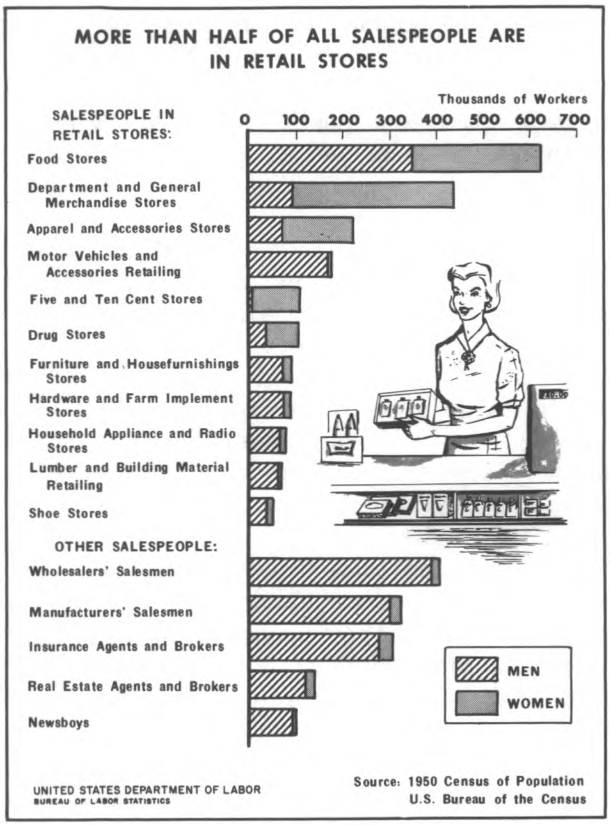
Sales workers are the link between producers of goods or services and the people who use these products. The things that sales workers sell include all items produced by American business—houses, automobiles, sheet steel, industrial machinery, clothing, food, insurance, stocks and bonds, and newspapers, to cite a few illustrations from a virtually endless list. Their customers include not only housewives and other individual consumers but also government agencies and business enterprises of all kinds.

Altogether, about 4 million workers were employed in sales occupations in 1958. Salespeople in retail trade are by far the largest group of sales workers, representing about 60 percent of the total number of such workers. (See chart 22.) Nearly all products used by consumers are sold one at a time or in small quantities by retail salespeople whose chief job is to display and sell merchandise to customers who come to them in the thousands of stores located in rural towns and communities, and cities of all sizes. Retail selling is an important source of employment for women. Men are employed almost exclusively in most other types of selling jobs. Salesmen employed by wholesale houses and those working for manufacturers each account for slightly more than 10 percent of all sales personnel. Wholesale salesmen travel within an assigned territory to retail dealers' stores mainly and take orders for the many brands of similar-type products which their wholesaler has brought together from various manufacturing plants. Salesmen employed by manufacturers also travel to their customers—usually wholesalers and other manufacturers—to demonstrate one or a few related items produced by their company. Insurance agents, who represent about 8 percent of the total sales group, seek out individual customers or company executives and sell policies that provide protection for life and property. (See chapter on Insurance Occupations for Casualty and Life Insurance Salesmen.) Real estate salesmen (a group somewhat smaller than insurance salesmen) deal with property and spend most of their time showing homes to prospective customers. Each of these large sales groups is described in the separate statements which follow.

Although the number of workers in each of the remaining sales occupations is small compared with total sales employment, several of the fields do afford employment for many people. For example, approximately 100,000 newsboys, 35,000 advertising salesmen, 23,000 hucksters and peddlers, 14,000 demonstrators, and 11,000 stock and bond salesmen were employed in 1950.

A rise in employment of sales personnel is anticipated over the long run, but the rate of growth is likely to be somewhat slower than in past decades. Employment in sales occupations rose by more than a fourth between 1940 and 1950 (a slightly greater increase than for the labor force as a whole); however, the rate of growth has slowed down considerably since 1950.

CHART 22



Much of the increase in employment since World War II has been the result of hiring more women part-time workers—most of them for jobs in retail trade—and of a shortening of the standard workweek. In mid-1958, saleswomen worked only about 34 hours a week, on the average, compared with an average of 42 hours for salesmen. The trend toward a shorter workweek for sales personnel is expected to continue. At the same time, the trend toward keeping stores open for a greater number of hours a week is likely to spread. These and other factors closely related to the need to distribute more and more goods to a rapidly increasing population point to a rising demand for sales workers. On the other hand, changes in distribution techniques—chiefly those involving self-service—will make it possible to bring goods to more customers without a corresponding increase in the number of salespeople. On balance, sales workers are expected to increase somewhat faster than the labor force as a whole during the 1960's, but much of the increase will be accounted for by part-time workers in retail stores.

Manufacturers' Salesmen

(D.O.T. 1–85. and 1–86.)

Nature of Work

Practically all manufacturers—whether they make airplanes or dolls, women's dresses, or nuts and bolts—employ salesmen to sell their products. Manufacturers' sales representatives sell mainly to other business concerns—sometimes to factories, railroads, banks, or other companies which use the products in their businesses; sometimes to wholesalers or, less often, to big retail stores. They go to see officials of these companies in their offices to acquaint them with the manufacturer's products and to convince them that these products are better than similar items made by other manufacturers.

Salesmen of highly technical products, such as factory machinery, metals, chemicals, or other materials for use in manufacturing, are often called sales engineers or industrial salesmen. Since purchases of these products are likely to involve large investments of money, the people who must be "sold" on buying them are usually heads of departments or other factory executives. Sales engineers should have a thorough knowledge of their firm's products and a great deal of imagination and sales "know-how" in order to convince officials that buying new machinery or particular types of raw materials will make their operations more efficient and profitable. To do this, sales engineers may spend days or even weeks in their prospect's plants analyzing manufacturing problems and discussing technical details with the company's engineers. Often, they work with the research and development departments of their own companies, devising ways in which their products can be adapted to a customer's particular needs. After a sale is made and the equipment installed, sales engineers sometimes train employees to operate and maintain the equipment properly. They make frequent return visits to see that the equipment is giving the desired service. Because sales engineers may work several months with a prospect before completing a sale, they are not likely to make as many sales as other salesmen, but a single order may amount to hundreds of thousands of dollars.

Manufacturers' salesmen selling nontechnical products—for example, clothing, food products, or stationery and other office supplies—also need a thorough knowledge of the items made by their companies and a sales approach adapted to the particular kind of goods they handle. Thus, a salesman of crackers or cookies may emphasize the popularity of his manufacturer's products, the attractive way in which they are packaged, and the many different kinds available. In selling clothing, a salesman needs a knowledge of style, design, fabrics, and the details of clothing manufacture.

Many salesmen handling nontechnical products sell chiefly to wholesalers. Their job is to call on wholesale houses in their territory to introduce new products and see that orders for established items keep coming in. In addition, they often set up displays in hotels and hold conferences with the wholesale salesmen in the area to encourage them to push the sale of their particular manufacturer's products. For the same reason,

Manufacturer's salesman points out special features of a small motor to a prospective buyer.

manufacturers' representatives may give wholesalers free advice on such problems as credit and pricing.

Besides selling to wholesalers and large retailers, salesmen of some types of products try to interest other groups in their products. For example, salesmen employed by drug manufacturers may call on members of the medical profession to distribute literature and samples of a new drug that has just become available.

Though manufacturers' salesmen spend most of their time in visiting prospective customers, they also do some paperwork when they are not busy selling. They must plan their work schedules, make appointments, compile lists of prospects, conduct some of their own sales correspondence, make out expense accounts, study literature relating to their products, and write reports not only on the sales made but sometimes also may include information on sales prospects in an area, their competitors' products, and the credit ratings of customers.

Where Employed

About 400,000 manufacturers' salesmen were employed in 1958. Some of these salesmen work out of their company's "home office," generally located at a manufacturing plant. However, most of them work out of branch offices, which are usually located in big cities where they can get the most customers. Over a third of the more than 23,000 home and branch sales offices maintained by manufacturers in 1954 were in the 10 largest metropolitan areas.

More salesmen work for companies which produce canned, frozen, and other packaged foods and meat, dairy, and bakery products than for companies in any other industry. Large numbers of technical salesmen are employed by manufacturers of machinery, such as office and store machines, tractors and other farm equipment, and industrial machinery. Companies manufacturing chemical products, particularly drugs, also employ large numbers of salesmen with specialized training. In addition, many salesmen work for manufacturers of apparel, fabricated metal products, textiles, paper and related products, and also in the rapidly growing field of electrical and electronic equipment.

Though manufacturers' salesmen often have large territories to cover and may do considerable traveling, those selling certain types of products have relatively small territories. For example, a salesman of heavy industrial equipment may be assigned a territory including several States. As a result, he may often be away from home for days or weeks at a time. On the other hand, a salesman working for a manufacturer of food products may work in such a small area that he can return home each evening.

Training and Other Qualifications

Manufacturing companies generally prefer to hire college graduates for training as salesmen. Most employers believe a college background is necessary since salesmen usually have to deal with high-level executives of other companies. As a rule, the job of selling complicated industrial equipment requires technical education; for example, manufacturers of electrical equipment, heavy machinery, and some types of chemicals, prefer to hire engineering or chemistry graduates for their sales staffs. (More detailed information on chemists, engineers, and others who work as industrial salesmen is given in the statements on each profession. See index for page numbers.) Some training in medicine or pharmacy is usually required for jobs as drug salesmen. (See statement on Pharmacists, p. 61.)

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Persons with degrees in liberal arts or business administration are often preferred by manufacturers of nontechnical products. However, it is still possible for persons with little or no college education to become manufacturers' salesmen if they have exceptional selling ability.

Although prospective salesmen can often get jobs by applying directly to sales offices of manufacturing concerns, many manufacturers send recruiters to colleges and universities to interview students who are about to graduate. Recruiters look for students who have not only the required academic qualifications but also records of participation in extracurricular activities. Since salesmen must be able to meet and get along well with many kinds of people, recruiters pay close attention to the personality traits and appearance of students. Preference is likely to be given to those with pleasant but forceful personalities who make a good impression in manner, speech, and dress. A recruiter may hire directly or recommend applicants to his company. In some cases, several executives of a company interview applicants before making a final selection.

A beginning salesman is usually given some training before being sent out to sell. Some companies, especially those manufacturing complex technical products, have training programs which may last two or more years. During this time, the prospective salesman may be rotated among jobs in several different departments in the plant and office to learn all phases of production, installation, and distribution of the product. Other companies arrange to have trainees take university courses in subjects related to their products. Still others give short courses at the plant followed by intensive training in a branch office, under the supervision of field sales managers.

Sales representatives with good sales records and leadership ability may advance to higher level positions, such as sales supervisor, branch manager, or district manager. Those with unusual ability and managerial skill may move up to sales manager or other executive positions; a sizable proportion of the top executive jobs in industry are filled by men who were once salesmen. Because salesmen come in contact with people from other companies, they often find opportunities to transfer to better jobs in those companies. Some salesmen go into business for themselves as manufacturers' agents selling similar products of several manufacturers. Experienced salesmen can often find opportunities in related occupational fields, including training of sales representatives, advertising, and market research.

Employment Outlook

Well-qualified men are expected to be in strong demand as manufacturers' salesmen through the early 1960's. Competition in promoting the sale of products will continue to be keen as manufacturers push the sale of established items and, at the same time, introduce new products. However, the continued high demand for manufacturers' salesmen is likely to be accompanied by more selective hiring policies. It was evident in 1958 that companies were raising their hiring standards. They were looking for the "go-getter"—the salesman with topnotch ability to go out and make sales. This careful selection of new recruits will undoubtedly continue. It is also likely that more and more employers will look for technically trained men who can sell the increasingly complex equipment now being used in many industries.

The continued expansion of the Nation's economy expected over the long run will tend to increase the employment of manufacturers' salesmen. The growth in population and number of families will create a demand for more products. Rising standards of living will also create a wider market for goods already being produced as well as for products not yet on the market. As manufacturers compete with each other to get new and improved goods on the market, more salesmen will be required to acquaint wholesalers and other customers with the rapidly changing products. Better methods of introducing and distributing products—which manufacturers' salesmen help to work out—will be necessary to keep pace with the Nation's rapidly increasing productive capacity. Salesmen will also continue to be in demand to demonstrate to industrial buyers the importance of using improved methods of production and to sell them new factory equipment and raw materials.

Although expansion of sales departments will create many openings for new workers over the long run, replacement needs will be the major source of job opportunities for manufacturers' salesmen. Retirements and deaths alone will probably account for at least 8,000 job openings each year.

Earnings and Working Conditions

Monthly salaries averaging about $410 were offered in 1958 to male college graduates hired for sales work by large companies. The average starting salary for those with the master's degree was approximately $445. Inexperienced people without college degrees generally start out in other types of jobs at lower salaries but may be given training at company expense to prepare them for higher earnings as salesmen later.

Some manufacturing concerns pay their salesmen a straight commission based on the dollar amount of sales made; others pay a fixed salary without regard to the amount of sales. However, most companies (about 70 percent in 1955) use a combination of these two plans. Although this method provides a fixed salary with an opportunity to earn a substantial additional amount through commissions, an upper limit on total earnings is set by some firms. Since the amount earned through commissions varies according to the salesman's ability, geographical location, nature of products sold, types of customers, the percent of commission allowed, and other factors, it is difficult to express the earnings of experienced salesmen in terms of averages. However, technical salesmen are usually the best paid. A survey of the earnings of all types of salesmen in more than 500 companies was made in 1955 by a private organization. When the highest paid salesmen in each of these companies were grouped together, their median (average) earnings were found to be $12,400; for most of these top paid salesmen, earnings fell between $9,500 and $19,000. When the lowest paid salesmen in the companies were grouped together, their median earnings were found to be $6,900, and most of them made between $5,000 and $8,000. The highest salaries are usually paid to top sales executives—sales managers or vice presidents in charge of sales. Their median base salaries, excluding bonuses, were $15,000 in small companies and $22,000 in large companies, according to a 1957 report. Bonuses of these executives generally averaged from 10 to 20 percent of base pay.

Salesmen are usually reimbursed for their expenses when away from home on business trips. Some of the items which may be included in expense accounts are transportation costs, hotel bills, meals, tips, customer entertainment, telephone calls, and stenographic services. Some companies either provide a car or pay an allowance to salesmen who use their own cars.

Salesmen have no standard working hours since they make calls at the times most convenient to their customers. Also, they often have to travel at night or on weekends. Frequently, they spend evening hours writing reports, planning itineraries, and scheduling appointments. However, in most cases, salesmen are free to plan their own work and can often arrange their schedules to have time off when they want it. Most salesmen have paid vacations of from 2 to 4 weeks, depending on their length of service. They usually share in company benefit programs, including life insurance, pensions, and hospital, surgical, and medical benefits.

Where To Go for More Information

General information on manufacturers' salesmen can be obtained from:

National Sales Executives, Inc.,
630 Third Ave., New York 17, N.Y.

Salesmen in Wholesale Trade

(D.O.T. 1–85. and 1–86.)

Nature of Work

Wholesale salesmen play an important part in the movement of products to retail stores where housewives and others can buy them. The wholesalers for whom these salesmen work assemble products of a similar nature from several manufacturers. For example, the wholesaler of automotive supplies fills his warehouses with the thousands of parts needed for automobile repair and maintenance, so that owners of garages, service stations, and retail stores can get their sup-

Wholesale drug salesmen often check the stock in retail stores and make up orders for needed drugs.

plies from one place instead of ordering each part from the factory where it is produced.

The job of the wholesale salesman is to call at regular intervals on retailers and purchasing agents in an assigned territory. He shows them samples, pictures, or catalogs of the items his wholesaler stocks, and tries to convince them that they will profit by buying these products. The salesman does very little "pressure" selling of any one article, since he may have a very large number of items to sell—as many as 50,000 if he works for a wholesaler of hardware or drugs. His chief interest is to persuade the retailer or purchasing agent of a hospital or other institution to become a regular customer of his wholesale house rather than to sell him any one item.

Success in wholesale selling depends on establishing a good personal relationship with customers. To do this, the salesman must give good service and prove that he is trustworthy. One of his major responsibilities is to see that retailers' shelves are well stocked at all times. When a retailer gets to know and rely on a salesman, he may allow the salesman to check the store's stock and make up his own order for what he thinks can be sold before his next regular visit.

Wholesale salesmen often help retailers by making window and counter displays of special or sale items and by suggesting ways to advertise new products. They may give advice to retailers on such matters as how much to charge for various items or how best to arrange goods in their stores. Some salesmen also collect the money owed their wholesale companies. Salesmen spend part of their time doing paperwork. They must write up orders and send them to the wholesale house, plan the next day's work schedule, make appointments, compile lists of prospects, make out expense accounts, study literature relating to their products, and write reports.

Where Employed

Nearly a half million salespeople were working for wholesalers in 1958. Less than 4 percent of these were saleswomen. Although wholesale houses are located mainly in cities, their salesmen go into all parts of the country. Wholesalers assign their salesmen to specific territories. A salesman's territory may cover only a small section of a city with many retail stores or, in sparsely populated regions, may cover more than half a State.

The leading employers of wholesale salesmen are companies that sell food products, including canned goods, fresh fruits and vegetables, meat, dairy products, fish, and candy. Large numbers of salesmen also work for wholesalers of electrical and electronic equipment, automotive equipment, dry goods, drugs, lumber, and other building materials.

Training and Other Qualifications

In hiring trainees for sales work, most wholesalers look for men with pleasant, outgoing personalities, a great deal of persistence, and the ability to get along with people. High school graduation is the usual educational requirement. However, in selecting salesmen of specialized products—for example, air-conditioning systems, medical supplies, and electronic equipment—employers are showing increasing preference for men with education beyond high school.

A young man who has the qualifications needed for selling may start in any type of job in a wholesale company and later apply for a sales job, or he may be hired directly as a sales trainee. In any case, the beginner must usually work in a number of inside jobs before being assigned as a salesman. He may start out in the stockroom or shipping department where he becomes familiar with the thousands of items the wholesaler carries. Later, he may be transferred to the pricing desk to learn prices of articles and discount rates for goods sold in quantities. The next job is likely to be order clerk, where he writes up orders that come in from customers by telephone. In this job, he gets to know many of the customers by name. The amount of time spent in these initial jobs varies from company to company; but, as a rule, it takes at least 2 years before the wholesaler feels that the trainee is prepared to go out and meet customers. Most wholesalers team a trainee with an experienced salesman who helps him with the problems of person-to-person selling. After a time, the junior or beginning salesman is given a small territory of his own.

Salesmen with the necessary leadership qualities and sales ability may advance to higher level jobs in the sales field—to sales supervisor, sales manager, and vice president in charge of sales. Other executive positions in wholesale houses are also frequently filled by men with sales experience. However, many men prefer to continue selling, because they enjoy this type of work or, in the case of very successful salesmen, because they can earn more money than in many other occupations.

Employment Outlook

Opportunities to work up to wholesale selling jobs are expected to be good, in the early 1960's, for energetic high school graduates with pleasing personalities. The continuing growth of the population, the resulting expansion in the distribution of food and other essential products, and the introduction of new types of products will provide a considerable number of new sales jobs. Employers were planning, in 1958, to expand their sales staffs in order to meet the strong competition for retailers' business. Furthermore, as many as 10,000 job openings may occur each year owing to retirement and death of experienced salesmen. Openings will also arise as some workers transfer to other jobs. A considerable amount of turnover occurs among new entrants who fail to make good.

Over the long run, employment of wholesale salesmen is expected to rise with the expansion of the Nation's economy. The growth in population and number of families coupled with an ever-rising standard of living will continue to create a demand for more goods, which will be distributed largely through wholesalers. Although employment is expected to rise, the increase will not be as great as might be indicated by the expansion in the volume of goods distributed. Many retail stores will continue to increase in size and will order a much larger quantity of goods through the same wholesaler. Furthermore, some very large stores will buy certain lines of goods direct from manufacturers. On the other hand, there is a trend, especially in drug and grocery stores, toward handling more and more unrelated kinds of goods, and this will tend to increase the employment of wholesale salesmen.

Wholesale selling is usually a steady year-round occupation. Employment and earnings are affected somewhat by general economic conditions, by the supply of goods available, and by seasonal differences in the demand for certain products, such as air-conditioners and furnaces. However, good salesmen are nearly always in demand. When business conditions decline, companies are likely to expand their efforts to increase sales.

Earnings and Working Conditions

Earnings of most junior or beginning salesmen in wholesale houses were between $300 and $450 a month in 1957, according to a survey made by a private organization. For trainees who were obtaining experience in inside jobs before assignment to sales work, salaries were from about $60 to $80 a week. Earnings of experienced wholesale salesmen typically were within a range of from about $4,000 to approximately $12,000 in 1957, the amount depending, in part, on the type of employing firm. For example, average 1957 earnings of salesmen with wholesale grocery firms were estimated to be $5,500; with hardware firms, $6,900; and with drug firms, $7,200. In addition, in each type of wholesale business, earnings vary from one part of the country to another. For example, earnings of hardware salesmen in 1957 averaged $4,000 in Kansas and Nebraska and about double that amount in Michigan, Ohio, and Indiana.

Wholesale salesmen are most often paid on a commission basis—that is, they receive a percentage of their dollar sales. The amount of commission may range from 1½ to 10 percent, depending on the nature of the product, geographical area, and other factors. Some wholesale houses pay their salesmen a low fixed salary plus commission. Most companies either provide each salesman with a car or pay an allowance if he uses his own car. Only a few wholesale houses pay their salesmen an allowance for other expenses on the road.

Wholesale salesmen travel from store to store in their assigned territory. If they cover a small area, they may be able to return home every night; whereas, those with large territories may be home only on weekends. As a rule, they cover smaller areas than do manufacturers' salesmen. They generally must carry heavy catalogs and sample cases and spend a great deal of time on their feet. They may have long working days since they must make calls at the times most convenient for their customers. They sometimes work evenings or weekends.

Most salesmen have paid vacations ranging from 2 to 4 weeks depending on length of service in a company. They are usually covered by company benefit programs including life insurance and pensions, and hospital, surgical, and other medical care.

Where To Go for More Information

Information on wholesale selling may be obtained directly from local wholesale houses or from associations of wholesalers in many of the larger cities. If no local association is available, write to:

National Association of Wholesalers,
1001 Connecticut Ave. NW., Washington 6, D.C.

Salesmen and Saleswomen in Retail Stores

(D.O.T. 1-70.; 1-75.; 1-80.)

Nature of Work

The job of the salesman who sells automobiles or pianos on a sales floor differs in many respects from that of the saleswoman who sells gloves or toothpaste from behind a store counter. However, regardless of the type of goods sold, all retail salespeople deal directly with the public and must give courteous and efficient service, since satisfied customers build the store's reputation.

In selling large, expensive items, such as furniture, electrical appliances, or some types of wearing apparel, the primary job of the salesman or saleswoman is to give the customer as much assistance as possible in order to create an interest in, and a desire to purchase, the store's merchandise. The salesperson may spend a large part of his time showing various styles or colors, demonstrating the article, pointing out its desirable features, answering questions about the construction or use of the product, and helping the customer make a selection. Special skills are required to sell certain items. For example, a salesman of automobiles must be able to drive and explain the advantages of power brakes and steering or other features of a new model car, or a salesperson in a music store may be required to play an instrument.

Salesclerks of groceries or of inexpensive, standardized items, such as many of those sold in drug stores, may have to do little more than assemble the goods ordered by the customer. In stores with goods arranged so that they can be easily taken off shelves or counters by customers —as in many 5 and 10 cent stores and newsstands —the salesclerks' chief duties are to tell the customer where to find merchandise, suggest additional items for sale, and wrap or bag the customer's purchases.

In addition to their selling duties, most salespeople must make out sales or charge slips. In many stores, they receive cash payments and give change and receipts. Salespersons are usually responsible also for keeping the sales counter, shelves, or floor neat and presentable at all times. In small retail stores, they may assist in ordering merchandise, stocking shelves or racks, marking price tags, taking inventories, preparing attractive merchandise displays, and promoting regular and special sales. (For information on salespersons in department stores see page 535, and on route salesmen who sell directly to customers on a regular route—for example, bread salesmen—see statement on Routemen, p. 425.)

Where Employed

Approximately two and one-half million salespersons—more than half of them women—were employed in 1958 in about 70 different kinds of retail businesses throughout the country. These stores range in size from the small drug or grocery store which employs only one part-time salesclerk to the giant department store employing hundreds of salespersons. About 45 percent of all retail salesclerks work in food, department, and general merchandise stores. Men predominate in stores selling furniture, household appliances, hardware, shoes, and lumber, and in automobile sales agencies. Women greatly outnumber men in department and general merchandise, 5 and 10 cent, apparel and accessories, and drug stores. (See chart 22.)

Although sales jobs are found in nearly every community, the vast majority of salespersons work in large cities and in the shopping centers of nearby suburban areas.

Training and Other Qualifications

Employers generally prefer to hire high school graduates for most sales jobs. Subjects such as salesmanship, commercial arithmetic, and home economics help to give the student a good background for selling positions. Many high schools have distributive education programs, which include courses in merchandising, principles of retailing, and retail selling, and also provide for part-time work (usually from 15 to 18 hours a week) in a local store. Employers cooperating in these programs usually offer full-time employment to students completing the courses.

Young people interested in obtaining sales jobs may apply directly to the owner of a small retail store or to the personnel office in larger retail establishments. Applicants are usually given personal interviews and, in some large stores, are required to take personality or aptitude tests. Employers prefer to hire people with pleasing personalities, an interest in sales work, a neat appearance, and the ability to express themselves well. Prospective salespersons should also be able to be on their feet for long periods. Part-time selling experience is helpful in obtaining a full-time job.

Saleswomen in dress shops must be able to discuss price, quality, style, and other features of the merchandise.

Nearly all retail stores give new sales personnel some type of on-the-job training. In a small store this may consist only of a short talk about the job, given by an experienced salesperson who may also be the proprietor; in a large store, training may last several days. Beginning salespeople are usually given instructions on how to make out sales slips and use the cash register; they are also informed about selling procedures and credit and other store policies.

Although some of the larger retail stores prefer to hire college graduates as salesmen, with a view to promoting them to executive trainee positions, retail selling is one of the few remaining fields where persons without college degrees, but with initiative and ability, have good opportunities to advance to executive positions. As a rule, employers promote salespersons who have good records of sales and service to customers, regardless of their educational background. Some salespersons advance to positions as buyers, department managers, or store managers, whereas others, particularly in large stores, may be transferred to administrative positions in personnel, public relations, or other fields of work. Opportunities for advancement are more limited in small stores where one person, usually the owner, frequently performs many different managerial functions. Sales experience in retail stores is often a valuable asset in qualifying for other types of sales jobs.

Employment Outlook

Many thousands of job openings for salespersons will occur each year throughout the early 1960's. Most of the new sales jobs are expected to arise in branches of large stores, which will be established in rapidly growing areas in and around big cities. The greatest number of employment opportunities will result, however, from the need to replace employees who resign or transfer to jobs in other retail stores or take jobs in other fields. Turnover is high in retail stores because of the many saleswomen who leave to marry or to take care of families and the large number of young people who change employment after gaining some sales experience. In addition to full-time sales jobs, there will be an increasing number of part-time jobs. These will provide many opportunities for regular part-time employment each week, as well as occasional work during peak selling periods, such as before holidays and during special sales.

Over the long run, employment of sales workers is expected to continue to rise, as retail stores sell an increasing amount of goods owing to growth in the Nation's population and income. However, the number of sales workers employed will probably not increase as fast as sales, for several reasons. More and more stores will be arranged so that customers can select goods from shelves or tables without the help of sales clerks. A growing number of large supermarkets, which typically operate on a self-service basis, is anticipated. These stores and other retail outlets such as drug stores are likely to handle more and more different types of merchandise in the future, and most of the additional items will probably also be sold by self-service methods. Furthermore, the trend toward larger retail stores of all types is likely to continue, and such stores employ fewer salespeople relative to the volume of sales than do smaller stores. On the other hand, the rising standard of living will tend to increase purchases of items such as electrical appliances, furniture, and apparel; personal assistance from salesmen and saleswomen in buying such items is not only considered desirable but is often necessary. In addition, more sales personnel will be needed if the workweek in retail trade is shortened, as seems probable. Considering the various factors affecting the employment of retail salespersons, it appears that the numbers employed will continue to rise, but at a slower rate than in the past.

Sales workers have more stable employment than workers in many other occupations. When retail trade is affected by downturns in the economy, employers—particularly in large stores—can cut employment by not filling vacancies that result from turnover, or they can eliminate some part-time jobs. Competition for sales jobs tends to increase when other jobs are hard to find, since many workers in other occupations can qualify as retail salesmen and saleswomen.

Earnings and Working Conditions

Salaries of beginning salespersons may range from about $25 to more than $50 a week depending on geographic location, type and size of store, and other factors. According to salary data based on a small number of union contracts with stores in cities and suburban areas, inexperienced salespersons working a 40-hour week generally earned from about $40 to slightly more than $60 in variety, hardware, bakery, drug, jewelry, and apparel stores in mid-1958. Experienced salespersons usually receive from $10 to $25 more than beginners in the same store. The highest earnings, often averaging $100 or more a week, are received by people who sell automobiles, major appliances, and furniture. These salespeople frequently are paid a straight commission or a salary plus a commission on sales—that is, a certain percentage of the amount of sales they make. Earnings of retail salespersons are usually highest in large metropolitan areas and lowest in rural communities. In retail stores, where the customer can easily make his own selection of goods—for example in 5 and 10 cent stores—salaries are, as a rule, lower than in apparel and other stores where salesmanship is an important factor.

Salespersons in many retail stores are allowed a discount, often from 10 to 20 percent, on merchandise purchased in the store. These discount privileges are sometimes extended to other members of the family. Some retail stores, especially the large ones, pay all or part of the cost of employee benefits such as life insurance, retirement, hospitalization, and surgical and medical insurance.

Many retail salespersons work a 5-day week of 40 hours or less. Since Saturday is a busy day in retailing, employees usually work that day and have a day off during the week. A longer than normal workweek is more common in some types of retail stores than others; for example, about half of all employees (in sales and other jobs) in furniture, home furnishings, and appliance stores worked more than 40 hours a week, according to a recent Bureau of Labor Statistics survey.

Longer than normal hours in retail stores may be scheduled for salespersons before Christmas and in other peak periods; employees who work overtime receive either additional pay or extra time off during slack periods. Some retail salespersons regularly work one or more evenings a week, especially in stores located in suburban shopping centers.

Retail salespeople usually work in stores that are clean and well lighted. Large stores are often air conditioned. Sometimes selling duties take the salesperson out of retail stores, as in the case of the automobile salesman who may visit his customers at their homes and take them on demonstration rides.

Where To Go for More Information

Information on retailing courses given in high schools may be obtained from the Superintendent of Schools, the Coordinator of Distributive Education in each community, or from the State Supervisor of Distributive Education in the Department of Education in the State capital.

Information on careers in retailing may be obtained from local retailers' or merchants' associations or from:

Committee on Careers in Retailing, National Retail Merchants Association,
100 West 31st St., New York 1, N.Y.

A list of colleges offering specialized courses in retailing is available from:

American Collegiate Retailing Association,
24 Waverly Place, New York 3, N.Y.

Real Estate Salesmen and Brokers

Nature of Work

The chief business of real estate salesmen and brokers is to act as agents between owners and buyers of homes and other properties. *Salesmen* (D.O.T. 1–63.10) are employed by brokers mainly to show and sell real estate. *Brokers* (D.O.T. 1–63.20) are independent businessmen who not only sell real estate but may also rent and manage properties, appraise their value, make or arrange for the loans necessary to finance sales, and develop new building projects. They may also have such responsibilities as managing an office, hiring employees, advertising property, and maintaining the contacts necessary in the business.

The majority of real estate salesmen and brokers sell houses. Some specialize in selling either low-price or expensive homes. A few, usually those in large real estate firms, handle mainly costly commercial properties, such as multimillion dollar hotels and giant office buildings. Others deal chiefly with farms and other land.

Since real estate usually costs a lot of money, most people buy it only after much careful investigation. For this reason, a salesman may have to meet several times with a prospective buyer to show him properties and answer questions about them. While doing this, the salesman emphasizes major selling points. For example, to a housewife looking at a house, he may point out the convenient floor plan and the fact that schools and shopping centers are close by; to her husband, he may emphasize the soundness of the construction and the attractive financing arrangements available.

In selling commercial property, especially, the real estate salesman or broker must be able to discuss such matters as how the property can be used, zoning restrictions, tax rates, and insurance needs. The agent sizes up the buyer's needs and preferences and tries to meet them within his ability to pay; this is important since a great

Real estate salesman showing new home to prospective buyers.

deal of time may be lost with buyers who cannot qualify for the loans required to finance the purchase. Where some bargaining on price may be necessary, the salesman or broker must carefully follow the seller's instructions and be skillful in making counteroffers, in order to get the best possible price and still make the sale. In the closing stages of the sale, the real estate salesman or broker often arranges for a loan, a title search, and the meeting at which the owner finally takes possession of the property.

Real estate salesmen or brokers also do some office work, such as checking listings of properties for sale or rent and phoning prospective clients. They may also answer telephone inquiries about properties, arrange appointments to show real estate, make out reports of activities, and keep records on properties sold. Real estate salesmen or brokers generally have a great deal of independence and personal responsibility for planning their work. It is often necessary to work during evenings and weekends.

Where Employed

More than half a million people were licensed as real estate salesmen and brokers in 1958; perhaps as many as a fifth of the licenses were held by women. Many of these licensed salesmen and brokers work only part time or occasionally in the real estate business. A large number of brokers combine real estate with insurance work.

Real estate brokers and salesmen work in every section of the country, mostly in small businesses. The relatively few big real estate firms are located chiefly in large metropolitan areas; salesmen employed by these firms are often assigned to work in a specific section of a city. Although agents are concentrated in large cities, opportunities are increasing in smaller, newly developed areas with rapidly growing industries and population.

Training and Other Qualifications

A license is required for work as a real estate salesman or broker in the District of Columbia and in every State except Rhode Island and New Hampshire. Most States require prospective agents to pass written examinations which generally include questions on the State license law and fundamentals of real estate transactions. The examination is more comprehensive for brokers than for salesmen. In addition, in more than one-fourth of the States, candidates for the broker's license must have had a specified amount of experience as a real estate salesman (generally 6 months to 3 years, depending on the State law); in some States, credits in real estate education may be substituted for experience. State licenses can usually be renewed annually without reexamination. Real estate agents who move to another State must generally qualify under the licensing law of that State.

Although a specified amount of education is seldom required for real estate salesmen, employers prefer to hire those who have at least a high school education. Aptitude for selling and skill in dealing with people are essential. Maturity is rated as an important attribute by employers, since agents who show a broad understanding of a homebuyer's problems and who are able to inspire his confidence have a better chance of making a sale.

Young men and women interested in beginning jobs as real estate salesmen often apply to brokers in their own communities where they can use their knowledge of local neighborhoods to advantage. The beginner usually works under the direction of an experienced salesman or broker while he learns the practical aspects of real estate selling. After a few years of experience, the salesman who becomes a licensed broker may open his own office.

Opportunities exist to obtain educational preparation for real estate work, which is helpful to experienced agents as well as to beginners. Many of the local real estate boards, members of the National Association of Real Estate Boards (NAREB), sponsor courses in such subjects as real estate fundamentals; principles and practices; real estate law; and real estate financing. Agents who handle the more complex work of selling commercial properties or those who wish to enter other phases of real estate work—appraisal, mortgage financing, and property development and management—will find advanced courses helpful. Many local real estate boards offer such courses and various affiliates of NAREB—for example, the American Institute of Real Estate Appraisers—offer course work in their specialized areas. A number of colleges offer one or more courses in real estate and some offer the bachelor's degree with a major in real estate; a few offer advanced degrees.

A member of the NAREB may use the term "realtor" if he meets certain requirements. This designation has prestige value in the real estate field. Qualified people may become members of the American Institute of Real Estate Appraisers, the Institute of Real Estate Management, and the National Institute of Farm Brokers (all affiliated with the NAREB). Such membership indicates recognition in specialized fields.

Employment Outlook

Many opportunities to enter the real estate field are expected, continuing through the early 1960's, but competition for sales will remain keen. Increasing population, the growing size of families, and frequent changes of residence are major factors which are expected to help in maintaining a high level of real estate activity. However, people seeking to make a career in this field will have to compete with many thousands who work only part time selling real estate. Although part-time work enables many people to supplement their incomes, it decreases the number of sales that can be made by full-time agents. Nevertheless, many opportunities to establish a career in real estate will be available for persons who have a real aptitude for selling and who are able to finance themselves during periods when business is slow. In general, mature men will be most in demand, but women are finding increasing opportunities because of their ability to explain special home features to housewives, who play an important part in deciding on home purchases. Best opportunities for entering large companies as trainees will go to those with specialized training in real estate and closely related fields, such as appraisal, property development, and management. A number of openings for college graduates with training in real estate will also arise in banks, insurance companies, and other large firms with specialized real estate departments.

Over the long run, opportunities for real estate brokers and salesmen will increase, owing primarily to continuing population growth and the related need for more homes and business establishments. An important factor in creating an additional demand for real estate agents in the late 1960's and early 1970's will be the great increase in the number of young people reaching the age at which they will marry and seek homes. Many openings will also continue to arise from the need to replace experienced real estate agents who retire, die, or transfer to other jobs. The average age of real estate salesmen and brokers is considerably above that for workers in the majority of occupations and death and retirement rates are high. In addition, there is a high rate of turnover among real estate agents. Despite the many employment opportunities that will become available, real estate selling is likely to remain a highly competitive field, owing to the relative ease with which it can be entered.

Earnings and Working Conditions

Commissions on sales are the main source of earnings for most real estate salesmen and brokers. The usual commission on the sale of a moderate-price home was 5 percent in 1957. Thus, a broker who sells a house in the $10,000–$12,000 price range would earn about $500 in commission. When a salesman completes the sale, he usually gets about half of the commission, while the broker or real estate firm receives the rest.

Earnings depend greatly on the type of property sold and whether or not specialized work is done. For example, according to a 1954 study, the median (average) annual income of full-time brokers in California was approximately $4,000 for those who sold mainly homes. In contrast, those who sold or leased mainly commercial and industrial properties had average incomes of about $7,000, and those who specialized in work such as appraising and mortgage financing had average incomes of $13,500 annually.

Income usually increases as an agent gains experience, but earnings are also affected by individual ability, geographic location, economic conditions, and other factors. Those who are active in community organizations and in local real estate boards can broaden their contacts and, as a result, may increase their earnings. Earnings, especially for beginning salesmen, are often irregular; a few weeks or even months may go by without a sale, then several sales may be made close together.

Salesmen are provided with office space by the brokers for whom they work. They are expected to furnish their own automobiles. Those going into business as brokers generally need a modest amount of money to equip a small office and to meet expenses such as rent, advertising, and sometimes salaries of officeworkers. Beginning real estate salesmen and brokers should also have enough money to support themselves until their income from commissions becomes large enough to do so.

Where To Go for More Information

Information on licensing requirements for real estate salesmen and brokers is available from the Real Estate Commission or Board located in each State capital. This information can also be obtained from most local real estate organizations.

Information on education and training, and a list of schools offering real estate courses may be obtained by writing to:

Department of Education, National Association of Real Estate Boards,
36 South Wabash Ave., Chicago 3, Ill.

PROTECTIVE SERVICE OCCUPATIONS

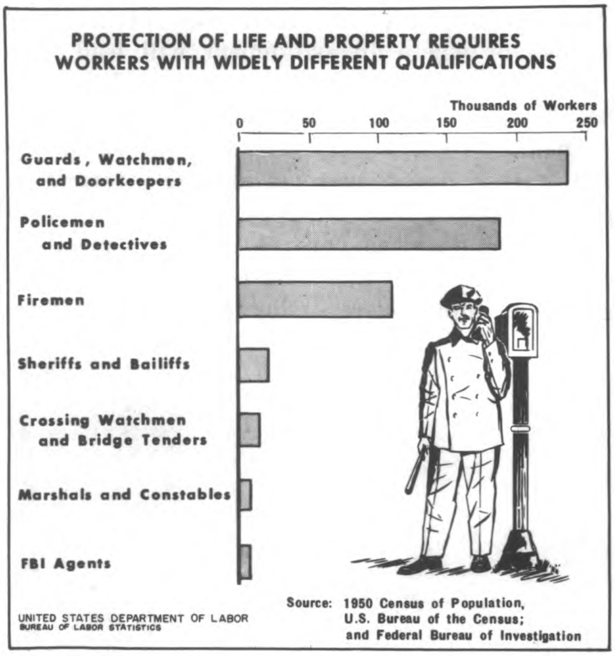
Protecting life and property is the chief job of about three-fourths million civilian workers in the United States. Guards, watchmen, and doorkeepers make up the largest single group of protective-service workers—about two-fifths of the total number in 1950. (See chart 23.) Some workers in this group are employed by private companies to guard their property and enforce company rules and regulations; others are employed in jails and other Government buildings. Policemen and detectives are the second largest group of protective service workers—about one-third of the total number. Most policemen and detectives are Government employees, but some work for hotels, stores, or other private companies, or are in business for themselves as private detectives. Firemen, who work mainly for city governments, represent nearly one-fifth of all protective service workers. The remaining small groups, who together represent less than a tenth of the total number, are sheriffs and bailiffs, crossing watchmen and bridge tenders, and marshals and constables.

A college education is needed to enter some protective service jobs. For many others, high school graduation is required, but for some there are no formal educational requirements. To become an FBI agent, for example, a young man must be either a lawyer or an accountant, and in most cities, young people seeking appointment to the police force are required to be high school graduates. On the other hand, the amount of education completed is not an important consideration for most guard and watchman jobs.

In addition to specific educational requirements, candidates for protective service jobs in government agencies may have to meet very rigid standards with respect to health, age, strength, and emotional stability. In contrast, guard and watchman jobs are frequently filled by handicapped persons or older men who have retired from other types of work.

The number of protective service workers in the United States has been growing faster than the population as a whole during the past 50 years—owing partly to the increasing proportion of people living in cities where there is most need for policemen and firemen. In 1910, there was only 1 protective service worker for every 450 persons in the United States; by 1950, the ratio had risen to 1 for every 260 persons, and in 1958, it was about 1 for every 240 persons. If the present ratio of protective service workers to population is maintained, at least 200,000 more such workers will be employed in 1975 than in 1958. In addition, thousands of new workers will be required each year to replace those who retire, die, or transfer to other occupations. There will be many openings for protective service workers even in years when the general level of business activity is declining. Since police and other protective services are always necessary, employment is steadier in most protective service occupations than in many other fields of work.

CHART 23



The employment outlook for policemen, firemen, and FBI agents—three large protective service occupations which offer career opportunities for young people—is described in the sections that follow.

FBI Agents

(D.O.T. 2–66.99)

Nature of Work

Federal Bureau of Investigation (FBI) agents investigate many types of violations of Federal law, such as bank robberies, kidnapings, frauds against the Government, thefts of Government property, and cases of espionage or sabotage. Altogether, the FBI has jurisdiction over some 150 Federal investigative matters, and each agent may be assigned to work on any one of them. However, agents with specialized training in accounting are likely to be assigned chiefly to cases involving complex financial records; for example, frauds involving Federal Reserve Bank records. An agent can never be certain what his day will be like or where an assignment will lead him. He is subject to call 24 hours a day, and he must be available for assignment at all times.

Owing to the highly sensitive nature of the FBI's work, agents may not disclose information gathered during the course of their official duties to any unauthorized persons, including members of their families. The FBI is primarily a fact-gathering and fact-reporting agency; therefore, its agents function strictly as investigators, and they do not make recommendations pertaining to prosecution, express opinions concerning the guilt or innocence of suspects, or issue "clearances."

COURTESY OF FEDERAL BUREAU OF INVESTIGATION

FBI agents in training session study the use of fingerprints in identifying people.

Under ordinary circumstances agents wear regular business suits. They generally work alone and must maintain continual contact with their superiors by radio or telephone. Two or more agents always are assigned to handle arrests, raids, and other duties in which an actual or potential danger exists.

Where Employed

Most of the more than 6,000 FBI agents employed in early 1958 were assigned to the Bureau's 50 field offices located in major cities throughout the Nation. The remainder worked out of offices in Alaska, Hawaii, and Puerto Rico or were stationed at FBI headquarters at the U.S. Department of Justice, Washington, D.C. In addition to the field offices, there are FBI resident agencies, staffed by small numbers of agents, in many cities and towns across the United States. These agencies facilitate the prompt and economical handling of all investigative matters which are within the FBI's jurisdiction.

Training and Other Qualifications

Only graduates of accounting schools or resident law schools are eligible for appointment as FBI agents. Accounting graduates must also have had at least 3 years of practical experience in accounting or auditing or a combination of both. All applicants must be male citizens of the United States, between the ages of 25 and 40, and willing to serve anywhere in the United States or its territories. Furthermore, they must be at least 5 feet 7 inches tall; have unimpaired hearing, excellent vision and normal color perception; be capable of strenuous physical exertion; and have no physical defects which would prevent the use of firearms or the participation in dangerous assignments.

Applicants must pass a rigid physical examination as well as written and oral tests covering law, accounting, and aptitude for meeting the public and conducting investigations. All the tests except the physical examination are given by the FBI. In addition, exhaustive background and character investigations are conducted on all applicants. All appointments are made on a probationary basis and become permanent after 1 year of satisfactory service.

Each newly appointed agent is given 13 weeks of training before he is assigned to a field office. During this period, he becomes familiar with FBI rules, regulations, and investigative procedures; with other Government procedures; with defensive tactics; and with laboratory work, fingerprinting, and the firearms normally used by the FBI. After he is assigned to a field office, the new agent works closely with an experienced agent for a period of about 2 weeks before he qualifies for independent assignments. All higher grade positions are filled from within the ranks of FBI agents. It is possible, therefore, for an experienced agent to advance to more responsible administrative and supervisory positions, such as field supervisor, special agent in charge of a field office, and inspector.

Employment Outlook

Opportunities to become an FBI agent in the early 1960's probably will be limited to filling vacancies which arise. The FBI is a career service and its rate of personnel turnover traditionally has been lower than that of private industry and the Government as a whole. Accordingly, unless there is a substantial increase in the FBI's work which will require expansion of its investigative staff, it is not anticipated that many vacancies for agents will arise in the immediate future.

Earnings and Working Conditions

The entrance salary for FBI agents was $6,505 in the middle of 1958. This was somewhat higher than the usual starting salary for college graduates entering Federal employment. FBI agents, like other Federal employees, can advance in grade as they gain experience and also receive periodic within-grade salary raises if their work performance is satisfactory. The top salary for regular field agents was $11,090 in 1958; agents in supervisory and administrative positions received higher salaries.

Agents are subject to call 24 hours a day. They frequently work longer than the customary 40-hour week. If overtime averages as much as 6 hours a week, agents receive a flat amount of extra pay—$897 annually. They have paid vacations and sick leave, and annuities on retirement. Some aspects of the FBI agent's work are adventuresome; he travels frequently and meets all kinds of people. The work is potentially dangerous and involves a great deal of responsibility.

Where To Go for More Information

Additional information and application forms may be obtained by writing to Federal Bureau of Investigation, U.S. Department of Justice, Washington 25, D.C.

Firemen

(D.O.T. 2–63.)

Nature of Work

Fire fighters in city and town fire departments have the exciting job of protecting the public against the hazards of fire. Through efficient teamwork, they prevent the loss of life and minimize property damage from fire. When an alarm sounds at the station, firemen put on protective clothing and are ready to drive to the scene of the fire in a matter of seconds. They may fight fires ranging from spectacular waterfront blazes, requiring men and equipment from several fire companies, to smoldering trash fires that can be controlled with a fire extinguisher.

Because fire fighting is a dangerous and complicated activity, it must be well organized. The scene of a fire may appear to be one of confusion, with many fire trucks, thousands of feet of fire hose, and firemen working at a feverish pace. Nevertheless, each fireman performs specific duties under the supervision of a commanding officer. Some fire fighters are assigned to forcible

Fireman recruit learns to use lifeline while protected by net below.

entry jobs and use tools such as axes, crowbars, and fire hooks. Others are truckmen, hosemen, and laddermen who unreel and couple fire hose, put on nozzles, turn on water hydrants, direct streams of water on the fire, and set up ladders. Rescue teams carry people to safety and administer first aid. According to the judgment of the officer in charge, fire fighters may be shifted to handle any of these duties. After a fire is put out, firemen carefully inspect the premises to make sure no further danger exists; in this connection, they may put fire fighters on standby watch or use hand extinguishers on smoldering objects.

Between calls, fire fighters spend a great deal of time at the local station improving their knowledge of fire fighting and doing maintenance work. They participate in practice drills, lubricate and polish fire-fighting equipment, stretch hoses to dry, stand watch at fire alarm instruments, and verify and record alarms. They may also use their spare time to study fire manuals and textbooks in preparation for examinations. Since many firemen live at the station for 1 or more days at a time, they may take turns performing various housekeeping duties such as mopping floors or making beds. There is usually some leisure time in which to read, watch television, and play table tennis or other games.

Where Employed

More than 150,000 paid fire fighters were employed in 1958, mainly in city fire departments; only about 10 percent worked in towns and other small communities. The 5 largest cities—New York, Chicago, Philadelphia, Los Angeles, and Detroit—each employ more than 2,000 fire fighters; New York City employs more than 10,000. In contrast, cities with less than 50,000 population usually have fewer than 100 firemen each. A significant number—about 25 percent of all city firemen—work part time. Most of the part-time firemen are paid volunteers in cities with less than 5,000 population. In addition, there are many thousands of unpaid volunteer firemen in small communities throughout the country.

Training and Other Qualifications

To become eligible for appointment as a fire fighter, young men generally have to pass a written intelligence test, a rigid physical examination, and an athletic performance test (running, climbing, etc.) as specified by local civil service regulations. In most communities, these examinations are open only to men who are at least 21 years of age, meet certain height and weight requirements, have been residents of the city for a specified period, and have a high school education. The men who receive the highest grades on their examinations have the best chances of appointment, although credit is usually given for military service. Other factors such as previous fire-fighting training may also be considered. Experience gained as a volunteer fireman may improve a young man's chances for appointment to a regular job.

As a rule, the beginner in a large fire department is given training for several weeks at a fire service school maintained by the city. During this training, formal study is combined with practice drills related to the fundamentals of fire fighting—forcible entry, rescue work, first aid, and the use of equipment such as axes, bars, lifelines, chemical extinguishers, ladders, and pumps. The recruit is then assigned to a local fire company, usually as a hoseman, truckman, or ladderman. After 1 to 5 years of experience, he may be eligible for promotion. Eventually he may become an officer; in a large city, the line of promotion is to lieutenant, then to captain, battalion chief, deputy or assistant chief, and finally to chief. Chances for advancement generally depend upon the candidate's position on the promotion list, as determined by his rating on a written examination and on his work as a fireman. Throughout his service, the fireman continues to receive in-service training and spends many hours studying such subjects as hydraulics, ventilation, salvage, fire investigation and incendiarism, and fire prevention. This broadened knowledge helps him pass the subject matter sections of the promotion examinations.

Among the personal qualities which are important for fire fighters are above average physical stamina, mental alertness, courage, and mechanical aptitude. Leadership qualities and good judgment are valuable assets for officers, since they have the responsibility of establishing and maintaining a high degree of discipline and efficiency, as well as planning and directing the activities of firemen.

Employment Outlook

Several thousand employment opportunities for fire fighters are expected each year through the early 1960's. Most openings will arise from the need to replace men who retire, die, or otherwise leave the occupation; the replacement rate is higher than that for many occupations. A moderate number of new jobs will also become available, as some city fire departments enlarge their staffs and as new departments are formed to replace volunteer fire companies in rapidly growing communities. In addition, some openings will probably be created by further shortening of the workweek for fire fighters.

The number of young men who apply for fire-fighter jobs in large cities is usually higher than the demand, although the written examination and stiff physical requirements always eliminate many applicants. Competition for fireman jobs is apt to be very keen when there is considerable overall unemployment, since this is an extremely stable occupation and especially desirable when many other jobs are less secure.

In the long run, the employment of fire fighters is expected to increase moderately. Major factors which normally lead to an increased need for the services of fire fighters—urbanization, population growth, and increases in building construction—will continue to be partially offset by the strong efforts at fire prevention, widespread use of fireproof and fire-resistant materials in building construction, improvements in the techniques and equipment used to fight fires, and other factors. Many slum areas are being rebuilt or are being improved by the installation of modern cooking, heating, and lighting equipment which reduces fire hazards. In addition, it is expected that fire and building codes will continue to be revised with the growing knowledge of fire-prevention methods, fire inspection will be more thorough and frequent, and fire regulations will be more strictly enforced in growing cities and their suburbs. Despite all the efforts to reduce fire hazards, some growth in the number of regular fire fighters will be necessary as metropolitan areas increase in size. However, the greatest number of employment opportunities will continue to arise as a result of retirements.

Earnings and Working Conditions

Average (median) beginning salaries of fire fighters were $3,600 in small cities (10,000 to 25,000 population) and $4,350 in the largest cities (over 500,000 population) in 1957. Beginning salaries were as low as $2,500 in some cities and as high as $5,000 or more in others. Generally, firemen receive salary increases annually during the first 2 to 5 years of service. Maximum salaries of firemen (not including officers) averaged about $4,000 in small cities and $5,200 in the largest ones. Fire chiefs averaged $5,200 in small cities and $13,500 in the largest ones in 1957. At all ranks, some allowance is usually given for uniforms. Protective clothing, such as heavy rubber boots and coats, is furnished.

Full-time fire fighters have a longer than average workweek in most cities. Their hours on duty averaged about 60 a week in large cities and 72 in small ones in 1956. However, in some cities the workweek was 48 hours or less; in a larger number, it was 56 hours, whereas in others it was 84 hours or more. In most cities, firemen are on duty 24 hours and then off 24 hours, with an

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extra day off at intervals. They must work as many hours overtime as necessary to bring a fire under control. As a rule, they receive time off instead of extra pay for overtime work.

The job of fire fighter involves a risk of life or injury from sudden cave-ins of floors or toppling walls, in addition to the dangers from exposure to flames, smoke, and bad weather. In fighting fires in industrial establishments, firemen may come in contact with poisonous, flammable, and explosive gases and chemicals.

Firemen are generally covered by liberal pension plans, which often provide for retirement at half pay at age 50 after 25 years of service, or at any age if disabled in line of duty. Should disability occur, men may be transferred from active fire fighting to vacancies in such jobs as fire alarm operator or dispatcher. Fire fighters receive regular paid vacations like other city employees. In addition, because of the hazards of the occupation, provisions for sick leave are usually very liberal. Some fire departments allow fire fighters time off for working on holidays, although a substantial number give paid holidays.

A majority of fire fighters are members of the International Association of Fire Fighters.

Where To Go for More Information

Information on how to obtain a job as a fire fighter may be obtained from your local civil service commission or fire department.

General information on the occupation may be obtained from:

International Association of Fire Fighters,
815 16th St. NW., Washington 6, D.C.

Additional information on the salaries and hours of work of firemen in various cities is published in the Municipal Yearbook, available in many libraries.

Policemen

(D.O.T. 2–66.)

Nature of Work

Policemen who direct traffic on street corners, or patrol their "beats" on foot or in a police car, or make newspaper headlines by arresting dangerous criminals are all helping to enforce the law and thus protect lives and property. They work for local and State governments, chiefly for city police departments. There are other workers who also help to enforce the law—for example, Federal border patrolmen, sheriffs, and town constables—but they are not covered by this discussion of policemen.

Policemen in large cities usually begin their day by reporting at their local precinct station to answer roll call and stand personal inspection. They take notes while their superior officer briefs them on such matters as "wanted" criminals, stolen cars, and missing persons. Most policemen patrol an assigned "beat" on foot, in police cars, or on motorcycles. They may be assigned to a congested business district, a crowded tenement area, or an outlying residential development. Patrolmen become familiar with conditions on their beat; they know when shopkeepers open and close their stores; they are aware of local banking hours and payroll movements; they know the neighborhood "toughs." At night, patrolmen check to see that the doors of business establishments are locked and watch for suspicious-looking people. They report to their precinct at regular intervals through signal boxes or by two-way radios, and may receive special instructions regarding problems in their vicinity. In emergencies—riots, serious accidents, or fires—the patrolman on the beat is often the first to take action before reinforcements can reach the scene. Although in large cities many policemen are specifically assigned to traffic duty, patrolmen on their beats also watch for traffic violations and direct traffic if necessary. Whether on or off duty, policemen are expected to exercise their authority whenever necessary. Policemen spend part of their time filling out various forms such as "tickets" for parking violations and other traffic offenses, writing reports on arrests or stolen articles, and testifying in court.

In a large city's police department, some men are assigned to communications work, laboratory work, firearm or fingerprint identification, test-

Policemen investigating robbery of a safe.

ing for automobile drivers' licenses, duty at precinct jails, administration, or other special areas of work. A small number of policewomen are employed, mainly in crime prevention and detection work with girls and women. Detectives (plainclothes men) are usually assigned to burglary, homicide, narcotic, or other special squads with the job of tracking down criminals and solving serious crimes.

Where Employed

Approximately 210,000 policemen of all ranks were employed by city police departments in 1958. In addition, about 40,000 were employed by county governments and 25,000 by State governments. New York City had approximately 23,000 policemen in 1957; Chicago had 9,000; and Los Angeles, Philadelphia, and Detroit each had 4,500 to 5,000. In contrast, smaller cities (2,500 to 25,000 population) each generally employed fewer than 25 policemen.

Most policemen work outdoors, on beats which may range from a block or two in a crowded downtown district to a wide area in less thickly populated sections. However, some policemen perform their duties mainly indoors—for example, in laboratories or at desks in police headquarters or in local precinct stations. State policemen (sometimes called troopers or rangers) and county policemen cover broad geographic areas, patrolling highways and doing law enforcement work.

Training and Other Qualifications

To become eligible for appointment as a policeman, young men generally have to pass a written intelligence test, a rigid physical examination, and a test of strength and agility as specified by local civil service regulations. In many cities, these examinations are open only to men who are at least 21 years of age, meet certain height and weight requirements, have a high school education, and have been residents of the city for a specified period. Since personal characteristics such as honesty and emotional stability are important in police work, many departments give each prospective appointee an oral interview and investigate his character and background. Those who receive the highest grades on examinations and also rate high on personal evaluation have the best chances of appointment. Usually, credit is given also for military service.

As a rule, the beginner in a police department receives from 2 weeks' to several months' training at the police school maintained by the city. He practices shooting his revolver and takes lessons in self-defense, including boxing, wrestling, and judo. Formal instruction may be given on such subjects as local ordinances; State criminal statutes; patrol procedures; accident investigation; traffic control; and the law of arrest, search, and seizure; as well as first aid and other training to meet various emergencies—for example, handling explosives to delivering a baby. The recruit often patrols a beat with an experienced officer for a week or so. He is then assigned, usually to patrol or traffic duty. After some experience, the patrolman is eligible for promotion. In a large city, promotion to sergeant, lieutenant, and captain generally depends upon the candidate's position on the promotion list, based on a written examination and his work as a policeman. However, patrolmen are often promoted to the job of detective solely on the basis of an aptitude for investigative work or a citation for outstanding performance. The latter may also serve as a basis for promoting men to higher ranks in any type of police work.

Many training opportunities are available to help policemen improve their performance and prepare them for advancement. State police departments and most large city departments have in-service training programs. A limited number of police officers are selected to take advanced training at the National Police Academy in Washington, D.C., conducted by the Federal Bureau of Investigation. Several colleges and universities offer subjects in police science—including scientific investigation, police administration, and traffic control—and some institutions award the bachelor's and master's degrees with a major in this field. Some police departments pay all or part of the cost of college courses for qualified policemen. In the opinion of many police officials, college-trained men, especially those who have taken courses in police science, will have the best chances for advancement in the future, owing to the increasing need for men with specialized knowledge who can handle the complex work of modern police departments.

Employment Outlook

Many opportunities for qualified young men to enter police work are expected each year through the early 1960's. Several thousand new jobs will be created annually as police departments expand their law enforcement activities to care for a growing population. Additional thousands of men will be needed each year to replace those who retire, die, or transfer to other occupations. Policemen often retire before the usual retirement age for workers in most occupations. Chiefly for this reason, the proportion of policemen who have to be replaced yearly is higher than in many other occupations. Most openings will arise in city police departments. However, a growing number of jobs will also become available on State and county police forces, as these are increased to take care of patrol work on the Nation's rapidly expanding network of highways.

Employment of policemen will continue to rise over the long run, as further growth in population, particularly in and around cities, creates a need for more men to work in such areas as traffic control and crime detection and prevention. Police authorities, concerned over the rise in the number of juvenile offenders, will probably further increase preventive and enforcement work in this field. Of course, the number of policemen employed depends on the amount of money made available by city and State governments; however, because of the essential nature of the work, it is likely that appropriations will be increased to take care of growing needs.

The number of policemen needed in the future and the nature of their work will be influenced also by technological advances—the use of improved methods and equipment in police work. For many years, police departments have used automatic signal lights for traffic control, cars and motorcycles for patrol work, scientific methods for crime detection, and, more recently, radar and closed-circuit television in connection with traffic enforcement work. Despite these aids—and sometimes because of them—police employment has continued to grow. Further technological developments will probably increase the need for policemen with specialized skills and knowledge, as well as help to make police work more efficient.

The number of young men applying for jobs as policemen is usually greater than the number of openings. However, the written examinations and stiff physical requirements always eliminate many applicants. Competition for police jobs is very keen during periods of high unemployment, since this is an unusually stable occupation and considered especially desirable when many other jobs are insecure.

Earnings and Working Conditions

Beginning patrolmen had average (median) annual salaries of $3,600 in small cities (10,000 to 25,000 population) and $4,200 in the largest cities (over 500,000 population) in 1957. Generally, salaries are raised annually during the first few years of employment, up to specified maximum figures. For patrolmen, these maximums averaged approximately $4,000 in small cities and $5,200 in the largest cities in 1957. Detectives, sergeants, lieutenants, and other officers had higher salaries. Police chiefs averaged $5,400 in small cities and $13,000 in the largest ones.

Most policemen wear uniforms while on duty. However, allowances for uniforms are usually provided, and special equipment, such as revolvers, night sticks, handcuffs, and badges, is furnished.

The majority of policemen have a 40-hour workweek, although the average is 48 hours in small cities. They often work nights, since they generally rotate on a 3-shift basis; for example, shifts may be from 8 a.m. to 4 p.m., from 4 p.m. to midnight, and from midnight to 8 a.m. Those who are called to work in emergencies often receive additional time off or extra pay for overtime worked.

Policemen are generally covered by liberal pension plans which often provide for retirement at age 55 after 25 years of service, or at any age if disabled in line of duty. They receive regular paid vacations and, in a number of cities, are given time off for working on holidays. Sick leave and medical, surgical, and life insurance plans are also among the benefits provided.

In this occupation, men must often stand or walk for long periods in bad weather. The higher-than-average injury rate of policemen reflects the risks they take in pursuing speeding motorists, capturing lawbreakers, and rescuing would-be suicides. However, relatively few policemen are killed in line of duty.

Where To Go for More Information

Information on how to become a policeman may be obtained from local civil service commissions or police departments.

General information on the occupation may be obtained from:

International Association of Chiefs of Police,
704 17th St. NW., Washington 6, D.C.

Additional information on the salaries and hours of work of policemen in various cities is published in the Municipal Year Book, available in many libraries.

OTHER SERVICE OCCUPATIONS

About 7 million workers were employed in service occupations in early 1959 (not counting protective service workers, discussed in the preceding chapter). Included in this total were domestic service workers in private households; personal service workers, including barbers, beauticians, and practical nurses; and institutional service workers, such as janitors, waiters, cooks, and elevator operators. (See chart 24.) Altogether, these service workers comprised about 12 percent of the labor force—more people than were employed in each of the following occupational groups: professional, managerial, sales, or farmworkers or unskilled laborers.

Service occupations should not be confused with service industries. Service industries—which include hotels, automobile repair shops, amusement enterprises, and advertising agencies—employ not only workers in service occupations but also many professional, clerical, and skilled workers, such as mechanics, copywriters, actors, and stenographers. On the other hand, many workers in service occupations are employed outside the service industries; janitors in factories and porters on railroad trains are examples of service occupations found in manufacturing and in transportation industries.

Many service occupations require considerable skill and training; others require comparatively little. Barbers and beauty operators, for example, need vocational training and must usually obtain a license in order to qualify for regular employment. Chefs and cooks in restaurants must have either specialized training or experience. On the other hand, such workers as kitchen helpers, maids, charwomen, and janitors need little, if any, training.

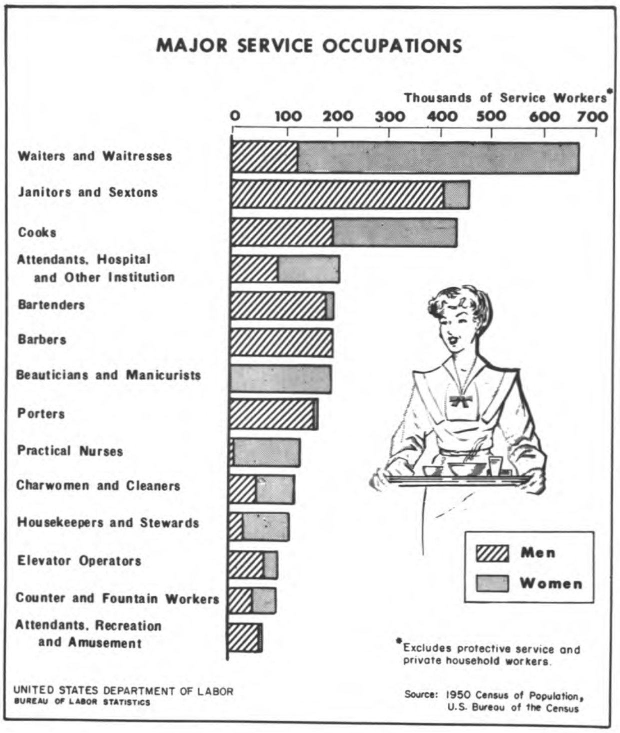
Employment Trends and Outlook

Private household workers, totaling slightly more than 2 million in early 1959, are the largest group in the service field. The number of domestic workers fell sharply during World War II, as is likely to happen whenever there is an acute shortage of labor, but has risen again. Between 1945 and 1955, employment of private household workers increased at about the same rate as the labor force; since 1955, the rate has been somewhat greater.

Employment in service occupations other than those in private households rose sharply during the 1940's and also in more recent years. Between 1940 and 1950, the number of service workers outside the home rose by more than one-third—faster than the labor force as a whole. Employment of these workers has continued to rise more rapidly than the labor force, recording a gain of 24 percent between 1950 and early 1959.

The fastest growing service occupation for which Census data are available has been that of attendant in hospitals and other institutions—employment in this occupation more than doubled between 1940 and 1950. During this period, employment also rose 50 percent or more in the following service occupations: bartenders, cooks, charwomen and cleaners, practical nurses, and professional and personal service attendants not elsewhere classified. The number of waiters and

CHART 24



waitresses, including counter and fountain workers, increased 40 percent. Only two large service occupations declined in size between 1940 and 1950—the number of boarding- and lodging-house keepers declined 60 percent and employment of barbers and beauticians dropped 8 percent. A substantial majority of the workers who entered service occupations during the 1940's were women; between 1940 and 1950, the proportion of women in service occupations, except private household work, rose from 38 to 45 percent.

Employment of service workers reflects the changing patterns of American living. Among the major reasons for the rise in service occupation employment, particularly outside private households, has been the urbanization of the population; the remarkable increase in the number of people employed in manufacturing and other nonagricultural industries; and rising income levels. Between 1940 and 1958, nonfarm employment rose more than 50 percent—nearly twice as fast as the population. Much of this increase was accounted for by a substantial rise in the number and proportion of working women in the labor force. These factors have greatly increased the need for services such as meal preparation and the care of the sick which, in former years, were provided to a much greater extent in the home. Between 1940 and 1950, half the rise in the total number of service workers outside private households was accounted for by greater employment in eating and drinking places and in hospitals and other health institutions. During this period, there was also an extremely sharp rise in the number of service workers in educational institutions, mainly to care for the many large, new consolidated schools and to provide meals for the many children who no longer brought lunches with them or went home at midday as was formerly the custom.

In the long run, employment in service occupations will probably continue to rise substantially. As in the recent past, most of this growth is expected outside private households. Nevertheless, some rise in employment of domestic workers is likely, in view of the increasing number and size of families and the rising number of working mothers with young children. However, most job openings for workers in all service occupations, both in and outside private households, will result from the need to replace the thousands of workers who annually leave their jobs. Turnover is high in these occupations for several reasons—the high proportion of women, especially in private household work; the many temporary and part-time jobs; and the relatively low rates of pay. These factors will no doubt continue to operate creating many thousands of job openings each year.

Additional information on service workers in several fields of employment is given in the chapters on the Hotel and Restaurant industries and in the statements on barbers, beauty operators, and practical nurses which follow.

Barbers

(D.O.T. 2–32.01)

Nature of Work

Nearly 200,000 barbers were employed in 1958 in more than 90,000 barbershops. In addition to cutting hair, barbers provide customers with other personal services, such as shaves, facial and scalp massages, shampoos, and hair singes. They sometimes sell hair tonics, shampoos, and related preparations, and give advice on care of the hair and scalp. Barbers must know the latest hair styles and be alert to follow customers' instructions on the type of haircut they prefer. They must also try to finish each haircut in the way best suited to the shape of the customer's head.

A barber builds up a steady trade not only by giving good haircuts but also by putting customers at ease, giving them quick and courteous service, and keeping a clean, attractive shop. In small shops, a barber may keep his own work area clean or take his turn sweeping the shop. Each barber is usually responsible for keeping his barbering tools sterilized and sharpened. Barbers who run their own shops have responsibilities common to many small businesses, such as ordering supplies, paying bills, and hiring and managing employees.

Most barbers work long hours but may have some slack time each day.

Where Employed

Most barbers are employed in small shops. The typical barbershop is a one- or two-man establishment in which the shopowner himself does all or part of the work. However, shops employing several barbers are to be found in large hotels and office buildings in downtown areas of cities and in a growing number of suburban shopping centers. A few thousand barbers are employed in beauty shops and combined barber and beauty shops.

All cities and towns and most villages have barbershops. However, barbers are concentrated in large cities and in most populous States.

Training and Other Qualifications

A license is required for both apprentice and master barbers in all States except Virginia. To obtain a license as an apprentice, the prospective barber must, in nearly all States, be a graduate of a State-approved barber school, pass a written examination, and demonstrate his ability to perform barber services in a practical examination given by the State board of barber examiners. In addition, most States require entrants to be at least 16 or 18 years of age, to have completed the 8th grade, and to meet certain health requirements. After receiving a license, the trainee must work as an apprentice in a barbershop for a specified period (18 months in most States). After completing this apprenticeship and, in most States, passing a second set of written and practical examinations, the trainee may be licensed as a journeyman (experienced) barber. Barbers who move to another State must usually take licensing examinations given by that State.

More than 100 public vocational schools and private barber colleges offer barber training. Courses are usually 6 or 9 months in length and include 1,000 or more hours of training. The prospective barber mainly studies basic barber services—haircutting, shaving, massaging, and facial and scalp treatments—and, under supervision, practices these services on people. In addition to attending lectures on barber services and the use and care of barber tools, students take courses in anatomy, sanitation, and hygiene, including the recognition of skin diseases. Instruction is also offered in salesmanship and general business methods.

Apprentice barbers may obtain their first jobs through employment services operated by the barber school they attend, through the barber's union, or through personal contacts in their local communities. Experienced barbers may advance by opening their own shops, by becoming managers of large shops, or by moving to shops which have more customers. Those who open their own shops must, of course, have the necessary capital to buy or rent quarters and equipment. The usual cost of equipping a one-chair barbershop is roughly estimated at $1,500. However, costs differ greatly, since barbers can sometimes buy used equipment and fixtures at low prices or may decide to pay above average prices in order to get the best equipment. Each barber usually buys his own scissors and other tools while in barber school, at a cost ranging from about $65 to $100.

Employment Outlook

Several thousand openings for barbers are expected each year during the early 1960's. Most openings will arise from the need to replace barbers who retire, die, or transfer to other fields of work. The death and retirement rate among barbers is high since they are an older group than workers in many other occupations. In addition, some experienced barbers, as well as many apprentices, are always attracted to other types of jobs.

Total employment in barbershops has been declining over the past 20 years. Among the factors contributing to the decline in number of barbers employed are the extensive use of mechanical and electrical razors which enable men to shave themselves easily, the raising of training requirements for new entrants to barbering, and the fuller use of the time of the barbers who have remained in the trade. The decline in employment has become slower during recent years, but the number of young men in the occupation has decreased.

A further decline in the number of barbers may occur in the early 1960's if other employment opportunities are easily available. Such a drop would result in steadier work and more business for barbers remaining in the field, since the growth in population will tend to increase the total demand for haircutting services. On the other hand, if an economic downturn should occur, thousands of barbers at work in other occupations might reenter barbering. This would create keener competition for barber jobs and curtail opportunities for newcomers to enter the field.

Over the long run, the growth of population will undoubtedly bring about an upturn in the total number of barbers needed. The small (one- or two-man) barbershop will probably remain the most common type of establishment; however, the continuing shift of population to suburban communities should result in more opportunities to open large shops in these areas and in a need for larger staffs in shops already established there.

Earnings and Working Conditions

Barbers typically earned between $3,000 and $4,000 in 1958. However, some barbers in the most desirable locations earned more than $5,000. These figures include tips, which often are an important part of barbers' earnings. Barbers tend to increase their earnings as they acquire a personal following. Those who own shops or are managers of large shops have the highest earnings. Most barbers not in business for themselves are paid on a commission basis—usually 60 to 70 percent of the money they take in—or receive salaries plus commission. However, some are paid straight salaries. In large cities, the average salary was around $70 a week in 1958. A barber's income depends in part on the location of the shop, since the income level and tipping customs of the community, the competition from other barbershops, and the prices which can be charged all affect earnings. Haircut prices, for example, range from less than $1 in some communities to $2 in others. In addition, some barbers charge $2.50 or more for special types of haircuts. Earnings, of course, depend also on the barber's skill and personality, which help build up a personal following.

Barbers often have a longer workweek than employees in many other occupations—usually 45 to 50 hours or more. Most shops are open 6 days a week, but nowadays more and more barbers are working only 5 or 5½ days.

General good health and stamina are important for barbers, since they must stand on their feet for long periods and, much of the time, work with both hands above shoulder level. Although barbers have to work steadily during peak hours and on especially busy days, they often have slack times when they can take care of their tools or attend to personal matters. One-week paid vacations are common; some employees receive 2-week vacations. Some union contracts provide insurance and medical benefits.

The principal union which organizes barbers —both employed barbers and barbershop owners —is the Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America. The Associated Master Barbers and Beauticians of America is an association which represents shopowners and managers only.

Where To Go for More Information

Information on State licensing requirements may be obtained from the State Board of Barber Examiners at each State capital.

General information on the occupation of barbers may be obtained from:

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America,
12th and Delaware Sts., Indianapolis 7, Ind.

National Educational Council, Associated Master Barbers and Beauticians of America,
537 South Dearborn St., Chicago 5, Ill.

Beauty Operators*

(D.O.T. 2–32.11 through .31)

Nature of Work

Most beauticians are all-round operators who provide their patrons with a variety of services, largely related to the care of the hair. They cut, style, shampoo, curl, straighten, bleach, or color the hair. In addition, they may give scalp and facial treatments, provide makeup analysis, remove superfluous hair, arch and tint eyebrows, and give manicures. Cleaning equipment and furniture and sterilizing implements are at times part of a beautician's duties. In small shops, which provide primarily hair services and manicuring, an operator may perform all the services the patron requests. In larger shops, where a wider range of services is available, operators may specialize in one phase of the work, as, for example, in hair styling, hair coloring, permanent waving, face or body treatments, or manicuring.

Where Employed

Beauticians, also called hairdressers or cosmetologists, work in all parts of the country, in both large and small communities. Rural areas have shown a growth in demand for beauty services, so that job opportunities are no longer concentrated entirely in cities.

A very large proportion of beauty operators are either self-employed or are employed in small establishments with one to three beauty operators in addition to the owner-operator. Large-scale shops employing a sizable number of all-round operators and specialists are few: probably less than 1 percent of all shops employed as many as 15 workers.

Most beauty operators worked in 1958 in the almost 140,000 commercial beauty shops licensed by State cosmetology boards with a small number working on Government bases, cruise ships, and in hospitals and other institutions. Some beauticians rent booths within a shop from the shop-owner, and operate independently.

Although men make up only a small part of the total number of beauty operators, their number has been growing since World War II because of availability of beauty culture training under the GI bill. Men are more often engaged in specialized work than are women, generally working as stylists, hair tinters, or shop managers.

Training and Other Qualifications

A beauty operator is required to obtain a license from the State cosmetology board in all States except Delaware and Virginia. The license is granted upon payment of a small fee (usually $5 to $15), after the applicant successfully passes an examination in both theory and practice of cosmetology. In order to take the examination, the applicant must satisfy certain requirements usually including a minimum age of 16 to 18 years, a health certificate, a minimum education through the 8th or the 10th grades, and completion of a cosmetology course in an approved private beauty school or a public vocational school. If a beauty operator desires to practice in a different State from the one in which she has a license, more than four-fifths of the States provide for reciprocity, on payment of the fee, usually without an examination.

Courses in the more than 1,000 private schools

Beauty students often practice new skills on one another.

*Prepared by the Women's Bureau, U.S. Department of Labor.

reported in 1958 usually consisted of from 1,000 to 1,500 clock hours of combined classroom work and practice in beauty service. In the majority of these schools, students could complete the courses in from 6 to 9 months. In a few jurisdictions, up to 2,500 hours of study and practice are required, thus lengthening the time necessary to complete the course to as long as 12 months. Cosmetology programs in public vocational schools are usually part of a 4-year curriculum leading to a vocational high school diploma. In some States, students who meet the State board requirements in cosmetology before completing the vocational high school academic program may secure a license and work part-time as beauty operators while completing the other courses necessary for a high school diploma. Apprenticeship training in a beauty shop, usually for a longer period than the term in a private school, is accepted as qualifying the applicant for the examination by less than half of the State boards. More than half the States provide a separate manicurist's license, requiring a substantially smaller number of training hours than for a beauty operator's license.

The new beautician's starting job is usually that of an all-round operator, performing a variety of services. Later, the operator may specialize in one particular type of work (for example, as hair stylist, hair tinter, facial or scalp specialist, or permanent waver). Hair tinting and dyeing is reported to be a rapidly growing specialty, offering premium salaries for those with high levels of skill and experience.

Beauty operators enter special fields either through experience and training on-the-job, or through post-graduate training courses. Post-graduate training schools, which exist in larger cities all over the United States, are licensed and regulated in the same manner as the basic training schools.

A trained and experienced operator may also find work as a manager in a large shop, as a teacher in a beauty school, as a representative for a manufacturer of cosmetics or beauty shop equipment, as an electrologist, or as an inspector for a State licensing board. For some of these positions, additional training may also be needed, since many State boards require teachers, shop managers, and electrologists to obtain special licenses. Furthermore, many States set higher age, education, and experience requirements for the teaching license.

Those with adequate capital may set up their own shops, working alone or employing other beauticians. The necessary capital for establishing a beauty shop differs according to number of booths, variety of services offered, and location of shop. Estimates indicate that the equipment for a one-booth shop would cost from $800 to $1,000, with costs increasing as the size of the shop increases. Purchase of used equipment may offer some savings. Expenditures for the initial stock of necessary supplies vary, ranging up to $200. Rental costs differ with the size and location of the shop.

A shopowner must be prepared to accept administrative duties, including recordkeeping, maintenance of property, control of supplies, and supervision of employees.

To be successful, the beauty operator must be able to establish friendly relationships with people. She must also be well groomed, since many patrons will identify her appearance with the results they wish to see in their own appearance. Dexterity is necessary in handling the hair, and a sense of form and artistry in cutting and styling is important; as are ability and willingness to follow instructions and customer's wishes. The work also calls for physical stamina, since a great deal of standing is required, except for persons who do manicuring only.

Employment Outlook

Expansion in employment is expected to continue in this occupation because of the demands of the growing population and the tendency for an increasing proportion of women to patronize beauty shops. From 1948 to 1954, beauty shop receipts increased 50 percent and beauty shop payrolls increased 45 percent. Although the introduction of inexpensive home-permanent-wave kits helped women meet the shortage of beauty services existing during and after World War II, it did not prevent further growth of the beauty service industry. Some industry representatives feel that the advertisement of these home kits has served to make the public generally more beauty-conscious, and has therefore been a spur to the beauty culture industry. The State Board Cosmetology Guide reports that the number of beauty shops in the United States increased by more than 27,500 from 1950 to 1958.

State cosmetology boards reported a total of more than 543,000 licensed beauty operators in 1958, an increase of almost 60,000 above 1950. However, the number actually employed as beauticians is lower, since some women may prefer to renew their licenses even during years when they are not working. In addition, many shop-owners, beauty teachers, and persons in other allied occupations must have licenses, although they are not working as beauticians in shops.

In addition to jobs created by expansion, tens of thousands of job opportunities will be created annually by turnover in the beauty service field. This is a type of work in which a large number of young women are employed and in which the turnover is high, because many leave to marry, raise families, or take other jobs.

There are good opportunities for employment in this field for mature and older persons. Ample opportunity for part-time work is another important feature of beauty shop employment.

Earnings and Working Conditions

Many beauty operators, working in shops as employees, are paid a basic wage plus a commission. Frequently, an operator must first take in twice her basic wage in customer's fees before being eligible to receive a commission. She then receives a specified percent of any receipts she takes in over this amount. However, some operators may be paid only a salary or only a commission. Information from scattered sources indicates that, in 1958, a beginning beautician was paid a basic wage of approximately $50 a week, depending upon the type and location of shop. (A number of States have minimum-wage rates applicable to beauty operators.) By building up the number of patrons, the earnings of the beauticians can be increased substantially. Highly experienced operators may earn from $75 to $100 a week, and stylists and specialists in exclusive shops as much as $150 or more a week, not including tips. Tips paid directly to the operators also increase earnings. The practice of tipping varies in different parts of the country, with more frequent and more liberal tipping in the larger cities. In some shops, where cosmetics are sold directly to customers, a small commission (up to 10 percent) may be paid to the beautician selling these products.

Incomes of owners of beauty shops vary greatly according to size and location of the shop. Earnings of the owner of an exclusive salon in a large city may be many times those of the beautician who owns a one-booth shop in a small town.

Most employed beauticians work 40 hours a week, although many areas still report workweeks of 44 hours and even longer. Hours may be irregular, however, frequently including evening and Saturday work. Some States have overtime pay provisions for hours beyond a specified minimum.

Most beauty shops have too few employees to be eligible for membership in group life and health insurance plans. However, beauticians employed in establishments such as department stores usually participate in the employee benefit plans for the organization, including sick and vacation leave and pensions. Most shops allow their employees at least 1 week's vacation with pay.

One union for beauticians is active in the United States: The Journeyman Barbers, Hairdressers, Cosmetologists and Proprietors' International Union.

Where To Go for More Information

State boards of cosmetology can supply information on approved schools and requirements. Local vocational schools and private beauty schools can provide information on how the student can meet these requirements. A list of federally aided vocational schools that offer beauty courses is published by the U.S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D.C. The following publication includes detailed information about the beauty service field:

Employment Opportunities for Women in Beauty Service, Women's Bureau Bulletin 260, 1956. Superintendent of Documents, Washington 25, D.C. Price 25 cents.

Practical Nurses and Auxiliary Nursing Workers*

Nature of Work

Practical nurses and auxiliary nursing workers assist in the care and treatment of the physically or mentally ill, under the direction of physicians or professional nurses. Their importance on the medical team has increased over the past decade as they have been utilized more and more to perform many of the less complex nursing tasks, thus freeing professional nurses for more skilled and specialized nursing services.

Licensed practical nurses (D.O.T. 2–38.20), also known as licensed vocational nurses, usually perform such duties as observing and recording symptoms and reactions of selected patients; giving prescribed treatments and medications; taking patients' temperature, pulse, and blood pressure; and helping with personal hygiene tasks. Practical nurses frequently provide most of the nursing care given to newborn babies, to mothers, and to chronically ill patients. They may also assist professional nurses with acutely ill patients, such as those recovering from major surgery, and with diabetic persons who must be taught how to use insulin. In all their work, practical nurses must refrain from performing nursing services which are beyond the scope of their training and skill.

Practical nurses in doctors' offices assist physicians or professional nurses in the examination of patients, give simple medications or treatments as directed, carry out routine laboratory tests, and perform some clerical duties. In industrial establishments, their duties may vary from first aid and emergency care at the place of business, to home-visiting services for workers and their families.

Among *auxiliary nursing workers*, most of the women are called *nursing aides* (D.O.T. 2–42.20) and most of the men, *orderlies* (D.O.T. 2–42.10) or *hospital attendants*. Auxiliary nursing workers, who are not licensed, generally acquire their training on the job and perform nursing duties of a less skilled nature than those of professional or practical nurses. Working under the direction of nurses in either of these groups, auxiliary nursing workers may be assigned such duties as making beds, serving meals, giving baths, answering calls, taking care of hospital equipment, and performing other tasks to assure the patients' comfort.

In recent years, many hospitals and institutions lacking sufficient numbers of professional and practical nurses in their psychiatric wards, have been giving special in-service training to auxiliary workers designated as psychiatric aides or assistants. Although the amount of their training and the level of their responsibility vary considerably among hospitals, these workers assist in providing the specialized type of care and treatment needed by patients who are mentally ill.

Where Employed

More than 165,000 licensed practical nurses (for further information on licensing, see below) were estimated by nursing officials to be employed at the beginning of 1956. The number of auxiliary nursing workers was probably almost twice as large. By far the largest group of practical nurses and auxiliary workers are employed by hospitals. According to the 1957 survey of the American Hospital Association, there were, in addition to professional nurses, about 450,000 allied nursing personnel in hospitals, including about 84,000 practical nurses; 288,000 nursing

Public health nurse shows a mother how to care for her baby.

*Prepared by the Women's Bureau, U.S. Department of Labor.

aides and attendants; 32,000 orderlies; 30,000 floor maids; and 12,000 floor clerks.

Practical nurses are also employed directly by patients or their families to give individual nursing care in hospitals or private homes. According to the 1950 census, there were about 70,000 of these private duty practical nurses. As practical nurses are being used in steadily increasing numbers for private duty in hospitals, this figure is now much larger. Also expanding are the numbers of practical nurses—and to some extent, auxiliary nursing workers—employed in public health agencies and nursing homes. Some practical nurses work in doctors' offices and a few in industrial establishments.

A majority of the practical nurses and nursing aides are mature women who have returned to paid employment after a period devoted to homemaking responsibilities. In many cases, these women were interested in assisting in nursing care but did not have the time or money necessary for the extensive preparation needed by professional nurses. Although most practical nurses are women, the number of men is increasing. However, most men performing nursing services are employed as orderlies, hospital attendants, or psychiatric aides.

Training and Other Qualifications

Formal training is required in most instances for those entering practical nursing service today. Not very long ago, the majority of practical nurses were either self-trained or learned their skills through practice on the job. Most auxiliary nursing workers still do not obtain any formal training prior to their employment.

Practical nurse training may be obtained in two major types of approved schools: Those operated by public school systems, usually as part of a vocational school or adult education program; and private schools, usually controlled by hospitals, health agencies, junior colleges and universities, or community organizations. The past three decades have seen a tremendous growth in the number of practical nurse training facilities. In 1930, there were 11 approved programs. By February 1959, there were 580 approved programs, about three-fifths of which were operating under public school supervision. In recent years, an increasing number of high schools have included practical nursing courses in their regular curriculum. Admissions to approved programs totaled 20,530 in 1957–58.

Approval of schools of practical nursing is given by State boards of nursing. Some schools also have the approval of the accrediting service of the National Association for Practical Nurse Education and Service. Standards of operation are set by State boards of vocational education for schools under their control.

Entrance requirements vary among schools of practical nursing. In general, candidates must have completed at least 2 years of high school or the equivalent if they are under 25 years of age, or have graduated from grammar school if they are 25 years of age or over. Some schools, however, require a high school diploma. Age limitations are not strict, although most schools prefer that candidates be between 18 and 50 years old. Candidates must be in good mental and physical health. They generally are required to take a psychological test, have a personal interview, and submit references and school records. In many States, candidates for licenses must be United States citizens or applicants for naturalization.

In schools of practical nursing which charge a tuition fee, the amount is usually about $50 to $100 a year. Vocational education programs under public school systems may charge tuition for nonresidents only. There are, however, incidental expenses for books, equipment, or uniforms in all these programs. Tuition scholarships and room and board are available in a number of schools. A stipend is usually provided in lieu of maintenance during the period of practice training.

The typical period of training for practical nursing is 1 year. However, minimum training time varies by State, with courses ranging from 9 to 18 months. Training covers classroom study of basic nursing skills and related subjects as well as supervised practice in applying these skills to actual nursing situations. The practice training is arranged to include a wide variety of nursing experiences so that practical nursing students may gain confidence in caring for patients and increase their knowledge of different types of services.

After completing a training program approved by the State board of nursing and passing a

State examination, practical nurses may obtain a State license. Most employers hire only licensed practical nurses. This requirement is a comparatively recent development as most legislation covering licensure has been enacted since 1945. By 1957, however, all States and Territories except the District of Columbia provided for the licensing of practical nurses.

Postgraduate courses are offered by a few approved schools, and additional in-service training is provided in some hospitals. These prepare practical nurses to give nursing care in such specialized areas as psychiatry, pediatrics, obstetrics, operating room technique, and medical and surgical nursing.

Auxiliary nursing workers, who usually are trained on the job, generally receive from 1 week to 3 months of training. In some hospitals or institutions, classroom instruction and demonstration may be supplemented with specified practice work. In others, training may be informal and consist of daily instruction by the supervisor on the immediate duties to be performed.

As the jobs held by auxiliary nursing workers are considered to be entry positions in most hospitals and institutions, there are seldom any formal educational requirements. However, a grammar school education is often considered desirable, and some practical experience may be preferred. Usually, the only formal requirements are that applicants be at least 17 years of age and physically able to perform the necessary tasks.

Many of the personal characteristics required of other nursing personnel apply also to practical nurses and auxiliary nursing workers. Most important, of course, is a desire to help sick people and an aptitude for the work. In addition, patience, dependability, and emotional stability are very much needed.

Employment Outlook

The demand for practical nurses and auxiliary nursing workers has continued strong ever since World War II. The critical shortage of professional nurses that began at that time resulted, in most hospitals and other health organizations, in a redistribution of nursing duties among various kinds of personnel with different degrees of preparation and training. With the rapid increase in our population and the widespread public interest in good health and the prevention of illness, demand for nursing care continues to grow. Although the number of professional nurses has increased steadily, the gain has been more phenomenal for practical nurses and auxiliary nursing workers.

In the past two decades, there has been a sharp upward trend in the number of practical nurses who have received formal training in approved schools. During the school year 1957–58, 12,407 persons were graduated from practical nursing education programs. However, a great many more newly licensed practical nurses were needed, according to leaders in the nursing field. The number of graduates is expected to continue to rise as a result of special appropriations made by Congress in 1956 to encourage the expansion and improvement of additional practical nursing programs and thus help ease the nursing shortage.

Employment opportunities for practical nurses and auxiliary nursing workers are expected to be plentiful well into the 1960's. The success of using these workers as members of nursing teams, under the direction of professional nurses or physicians, indicates that there will be greater utilization of these personnel in most hospitals and health agencies. Especially good opportunities are anticipated in the future for psychiatric aides and for all other trained nursing workers.

Earnings

Average salaries of women practical nurses employed by hospitals in 16 metropolitan areas in 1956–57 ranged from $38 a week in Philadelphia to $63 a week in the San Francisco-Oakland area, according to a survey of the Bureau of Labor Statistics. For women nursing aides in the same metropolitan areas, the range of average salaries was from $29 a week in Atlanta to $59 in San Francisco-Oakland and for men nursing aides, from $36.50 a week in Dallas to $62.50 in San Francisco-Oakland. In half the survey cities, practical nurses and nursing aides averaged a 40-hour workweek, but in the remaining cities their average hours ranged from 40.5 to 43 per week.

Annual salaries paid to practical nurses employed in public health services (non-Federal) averaged $2,929 in 1957. Graduates of approved schools of practical nursing who met civil service requirements and passed a written examination were hired by the Federal Government at $3,495 a year in 1958. Auxiliary nursing workers without approved training, who qualified for Federal employment by passing an aptitude test, were hired at $3,255.

Where To Go for More Information

Additional details about practical nurses and auxiliary nursing workers are given in a publication of the U.S. Department of Labor's Women's Bureau. The Outlook for Women as Practical Nurses and Auxiliary Workers on the Nursing Team, Bulletin No. 203–5. 66 pp. Washington, D.C., 1953. Price 40 cents.

Information about these occupations may also be obtained from:

National League for Nursing, Committee on Careers,
10 Columbus Circle, New York 19, N.Y.

National Federation of Licensed Practical Nurses,
250 West 57th St., New York 19, N.Y.

National Association for Practical Nurse Education and Service,
654 Madison Ave., New York 21, N.Y.

Skilled Trades and Other Industrial Occupations

The trades and other industrial occupations—skilled, semiskilled, and unskilled—together provided jobs for more than a third of all employed workers in the United States in 1958. The men and women in these jobs perform key functions in the economy. They help transform the ideas of the scientists and the plans of the engineers into goods and services. They help operate transportation systems, communication facilities, and atomic installations. They build homes, office buildings, and factories. Many work in factories where they build, install, control, maintain, and repair the tremendous amount of machinery needed by a complex industrial society. Others repair automobiles, television sets, and washing machines. The efficient operation of the Armed Forces also depends on skilled workers in uniform as well as upon civilian craftsmen who produce weapons, vehicles, ships, tanks, planes, and communications equipment.

The skilled trades and other industrial occupations provide most of the employment opportunities to young persons with mechanical or manual interests and abilities who do not intend to go to college. Within this job area, there is a wide range of occupations varying in skill and earnings from the unskilled laborer to the highly skilled tool and die maker.

Although the jobs in the trades and industrial occupational groups can be classified into three categories—skilled, semiskilled, or unskilled—there is no clear-cut dividing line between these skill levels and, therefore, the classification of jobs in terms of skill must always be somewhat arbitrary. This is so because the nature of the work performed in these jobs often changes as new machines or methods are introduced. Thus, some of the types of work formerly done by skilled workers have been broken down into several simpler jobs, each requiring a much shorter period of training than was originally demanded of the craftsmen. These simpler jobs can be performed by workers who are usually classified in the semiskilled category although, in some cases, they still retain the titles of skilled workers.

Similarly, job titles sometimes fail to indicate levels of skills. For example, the job title "carpenter" may designate workers at various skill levels, ranging from those who are able to work from blueprints in fashioning a complicated structure to those who have little more skill than handymen, using only a saw and hammer. On the other hand, there are workers in jobs that generally are designated as semiskilled who might be considered skilled, based on their training, functions, and earnings.

During the past two centuries, the occupational structure of our economy has undergone a major but gradual transformation as a result of the widespread introduction of machinery and mass-production techniques. The emergence of the factory system of production, which emphasized the division of labor and specialization of function, changed our economy and resulted in the appearance of many new skills and trades. New occupations developed and others changed drastically. The manufacturing industries, with their greater potential for division of labor, were particularly influential in these occupational changes. The grouping of labor into such categories as skilled, semiskilled, and unskilled was primarily a result of factory production methods.

During the past several decades, the steady advance of technology, in the factories and on the building site, has been chiefly responsible for the sharp reduction in the number and proportion of unskilled workers in the work force. On the other hand, the numbers and proportions of skilled and semiskilled workers in our working population have increased.

Today, many people believe the United States is on the threshold of a new age of technological progress which may have major effects on the future occupational structure of the labor force. Rapid advances in the industrial application of scientific knowledge and invention, particularly in the field of electronics, are making possible more widespread "automation" of work processes. Automation is a term which has been used in the past several years to describe this most recent technological phase of industrial development. Although automation has been defined in many ways, it is generally agreed that, in our factories, it involves the use of electronic,

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mechanical, hydraulic, pneumatic, or other devices to feed, control, handle, and adjust the machinery and equipment used in production processes.

Automation has had limited application in industry generally and, therefore, it is still too early to know the full impact it may have on employment and on occupational skills. However, employment in the skilled and semiskilled groups is expected to continue to increase substantially during the 1960's despite the increasing rate at which industry is mechanizing and automating its production processes. With respect to skill requirements, it is expected that our increasingly complex technology generally will require workers with higher levels of skill.

Changes in employment and skills in the skilled, semiskilled, and unskilled groups in the 1960's generally will represent extensions of recent trends that have resulted from technological progress. Employment of skilled workers is expected to increase at about the same rate as the Nation's total working population which, it is estimated, will grow by about 20 percent in the next decade. With the increasing use of complex and costly automatic and semiautomatic machinery, more highly skilled craftsmen will be required to make, install, operate, and maintain such machinery. In addition, the employment of skilled building trades workers will grow substantially as a result of the expected large increase in construction activity.

The semiskilled group is expected to grow at a somewhat slower rate than the skilled worker group. As simple, repetitive operations such as the loading or unloading of machines are increasingly taken over by automatic and semiautomatic devices, the growth of the semiskilled group will slow down. This group may decline somewhat as a proportion of the total working population. Little change in the number of unskilled laborers is expected despite the continuing substitution of machines for manual laborers. As a proportion of our working force, however, the long-term decline of this group is expected to continue.

The reports on the trades and other industrial occupations which follow this introduction are grouped by industry or field of work, rather than by level of skill, since this is the most useful grouping for practical vocational guidance. The occupations which are found in a wide variety of industries or activities, or in industries for which an entire chapter has not been prepared, are included in this section of the Handbook. The great majority of the trades and other industrial occupations, however, are described in the section on Some Major Industries and Their Occupations.

Skilled Workers

Our Nation's economic and military strength depends to a great extent on the initiative and competence of its craftsmen. The contributions of our physicists, engineers, chemists, and other professional workers to our national security and well-being are transformed into goods and services by a skilled, intelligent, and flexible work force.

Skilled workers make the patterns, models, tools, dies, machines, and equipment without which industrial processes could not be carried out by semiskilled and unskilled workers. Skilled craftsmen repair the equipment used in industry as well as the mechanical equipment and appliances used by consumers. They also construct our homes, commercial and industrial buildings, and highways.

Skilled workers must have a thorough and comprehensive knowledge of the processes involved in their work. They exercise considerable independent judgment and often have a high degree of manual dexterity. In some instances, they are responsible for valuable equipment or products. Workers in skilled occupations usually receive an extensive period of training.

Young people who do not expect to go to college should consider seriously the definite advantages which the skilled trades offer, compared with semiskilled, unskilled, and other occupational groups. Skilled workers have higher earnings, more job security, better chances for promotions, can move more easily to similar jobs in other areas, and more opportunities to open their own business, than most of the other groups in our working force. Of the 11 occupational groups which make up our labor force, only the professional and managerial worker groups had higher average annual earnings than craftsmen in 1957.

The greater job security of skilled workers compared with semiskilled and unskilled workers was clearly evident during the 1957–58 recession. Their rate of unemployment was about half as great as that for the other two worker groups. Employers were reluctant to lay off skilled maintenance workers, tool and die makers, electronic servicemen, and other skilled workers.

Many supervisors and men in high administrative positions in industry have come from the ranks of craftsmen. Employers have long recognized the value of executives who have both industrial know-how and administrative ability. They have drawn many of these people from the ranks of skilled workers—especially those who have received apprenticeship or other well-rounded training.

With training and experience in a skilled craft, a man has a wider choice of jobs than do workers in most of the other occupational fields. It is easier for him to shift to other jobs within an industry as well as to jobs in other industries. Such a worker is able to handle not only the skilled job in the plant, but also, if necessary, one requiring less skill.

The key functions performed by craftsmen explain why employment in the skilled occupations has grown from about 5 million skilled workers and foremen in 1940, or about 1 out of 9 of the civilian working population, to about 8.5 million, or about 1 out of 8, in 1958. Continued growth in the number of skilled jobs is expected in the next decade. Even more job opportunities for young persons to become craftsmen each year will result from the need to replace skilled workers who retire, die, transfer to other fields of work, or are promoted. At least 170,000 skilled workers will be needed each year in the 1960–70 decade just to replace those who retire or die.

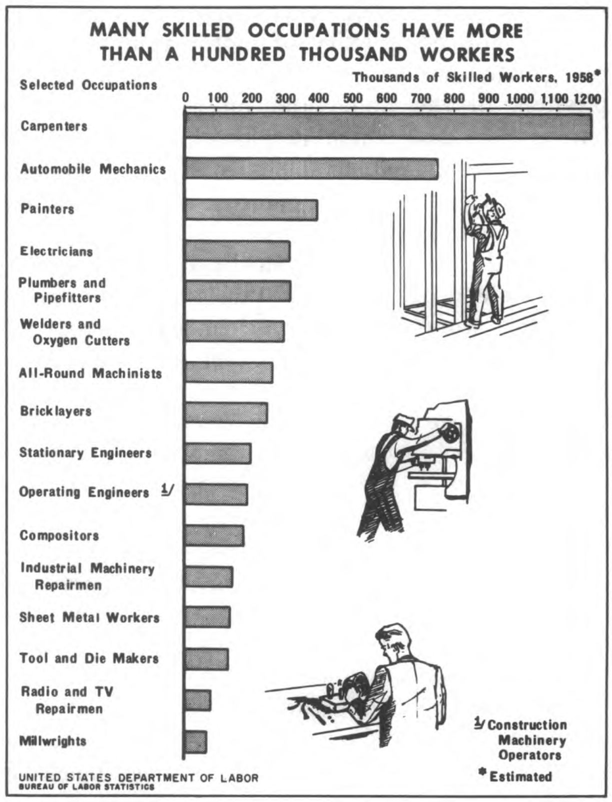
Skilled workers are employed in almost every industry, but the largest numbers are employed in manufacturing and construction. A large majority of all employed craftsmen are wage or salary workers for private employers; others are self-employed or work for Federal, State, or local governments. The building trades have a fairly large percentage of self-employed craftsmen. As might be expected, employment of the skilled work force is concentrated in the highly industrialized States, for example, New York, California, Pennsylvania, Illinois, and Ohio. Job opportunities for skilled workers, however, are found in every State. Only a very small proportion of skilled workers are women.

More than half of the country's skilled workers in 1958 were employed in three broad occupation groupings—building trades, mechanics and repairmen, and skilled machining occupations. At least 14 skilled occupations had more than 100,000 workers each in 1958. There were more than a million carpenters and about three-quarters of a million automobile mechanics. (See chart 25.) Many skilled occupations, however, have relatively small numbers of workers.

Employment Trends and Outlook

Employment of skilled labor has fluctuated with changes in business conditions and in requirements for national defense. During the

CHART 25



depression of the 1930's, employment of skilled workers declined greatly, reversing the upward trend of the previous two decades. With the start of World War II, the demand for skilled workers in war industry production rose sharply.

By 1944, employment of skilled workers had increased to about 7 million from about 5 million in 1940. After World War II, as industrial activity expanded to meet the accumulated demand for consumer products, employment of skilled workers rose steadily, exceeding 8 million by 1948. Although employment of skilled workers declined during the postwar recessions, employment in this group tended to move upward. In 1958, about 8.5 million craftsmen, foremen, and kindred workers were employed.

There have been differences in the rates of growth in the occupations within the skilled group in the past several decades; a few occupations have even declined. Those occupations which are concerned with the repairing and servicing of machinery, equipment, and appliances have shown the most rapid rate of employment growth. This expansion has been due largely to the growing introduction of more machines, which are becoming increasingly complex, in many manufacturing industries; the growing number and complexity of motor vehicles; and the greater use of electrical and mechanical appliances in the home and on the farm. The building trades, which employed a third of all skilled workers (about 2.9 million) in mid-1958, also experienced rapid growth. On the other hand, in some skilled occupations (for example, blacksmiths) employment declined.

By the end of the 1960–70 decade, employment of skilled workers is expected to reach nearly 11 million as a result of factors such as the prospective growth in industry and its increasing need for skilled workers resulting from technological advances. As in the past, however, there will be differences in the rate of employment growth for workers in many skilled occupation groups. For example, as mechanical equipment becomes even more widely used, the very large mechanics and repairmen group of occupations should continue to grow at a faster rate than that for the skilled work force as a whole. There will be many thousands of job opportunities for auto mechanics, industrial machinery repairmen, maintenance electricians, diesel mechanics, business-machine repairmen, and refrigeration and air-conditioning mechanics and repairmen. Similarly, the skilled building trades are expected to show a more rapid employment growth, principally as a result of the anticipated large rise in construction activity. On the other hand, the printing trades, also one of the large groups of skilled workers, probably will increase at a somewhat slower rate than the skilled work force as a whole. Another large field of employment opportunities for skilled workers will be the major skilled machining occupations—tool and die maker, machinist, instrument maker, skilled machine-tool operator, setup man, and layout man.

Training

Skilled workers learn their jobs in several different ways. Many workers acquire their skills through apprenticeship or other formal training programs. Many others, particularly during periods of labor shortage, acquire the skills of their trades through experience on the job, but without participation in a planned training program. Large numbers of young men also acquire skills in the armed services. For others, vocational school training plays an important role in developing skills.

Most training authorities agree that the best way to learn a skilled trade is through a formal apprenticeship program. Apprenticeship is a period of systematic on-the-job training, supplemented by related trade instruction, which is designed to acquaint the apprentice with the materials, tools, and principles of the trade. The apprenticeship program provides the worker with a balanced knowledge of his trade and the ability to perform his required duties competently. The formal apprenticeship agreement stipulates the number of hours of training the apprentice is to receive in the various aspects of the trade. Most apprenticeship programs run for periods varying from 3 to 6 years.

Apprenticeship has a number of advantages over less formal methods of learning a trade. An apprentice receives broad training and experience which enables him to adjust more easily to changing job requirements. He is likely to be more versatile and able to work in a wider range of jobs. The completion of an apprenticeship gives the worker a recognized status which gives him an advantage in finding new jobs, as well as greater job security. Many firms select their foremen from among their apprentice-trained workers because they are likely to be thoroughly familiar with all aspects of the work being performed.

Many companies have established training programs which are not apprenticeships but which provide workers with systematic on-the-job training and, frequently, with supplementary classroom instruction. In these programs, new workers begin on the simplest tasks under the direction of a foreman or an experienced worker. They move to progressively more difficult work until they achieve the necessary skills.

Many young persons, in moving from one semiskilled job to another among different employers, acquire knowledge and skill which eventually enables them to become skilled workers. Others learn the rudiments of a skilled trade by attending vocational, trade, or technical schools. A small proportion of these graduates are able to move directly into jobs in their trade and, after acquiring experience on the job, are able to qualify as skilled workers. In other cases, young persons who are already employed in semiskilled or unskilled jobs have been able to move into the skilled categories by taking vocational courses related to their work.

Large numbers of young men in the Armed Forces acquire skills which enable them to qualify, or shorten their training period, for skilled jobs in civilian life. Many of these servicemen are being given extended school and on-the-job instruction which helps prepare them for skilled or technical occupations, such as automobile mechanic, electronic technician, airplane mechanic, electrician, office-machine repairman, and painter.

In the years ahead, applicants for skilled jobs will have to meet increasingly higher standards. Industry will need craftsmen with higher levels of skill to do the complex work involved in rapidly advancing fields such as electronics and guided missiles. Young men who acquire a good basic education (including courses in mathematics and the sciences), as well as thorough job training, will be better able to compete for the higher paying skilled jobs in the future.

Semiskilled and Unskilled Workers

The largest occupational group in the Nation's labor force is made up of "operatives"—the Census classification for those who commonly are called *semiskilled workers*. In 1958, about 11.5 million workers—almost one-fifth of our entire labor force—were employed in semiskilled jobs. Women made up more than one-fourth of these workers.

As in other broad occupational groups, the semiskilled group includes jobs varying widely in nature and in levels of skill requirements. For example, the job of truckdriver, the largest occupation in the semiskilled group, may call for skill in maneuvering large trucks, knowledge of routes and highway trucking regulations, ability to deal with the public, keeping records of deliveries and collection, and independent responsibility and judgment. By contrast, in manufacturing industries, many semiskilled machine-tool jobs generally are limited to mastering a limited sequence of operations. Frequently, the operations require only the repetition of a few simple motions. The worker's efficiency is judged by his ability to adjust quickly to the sequence and timing of his operation and to attain an acceptable volume and quality of output. Other semiskilled factory jobs require somewhat higher levels of skill. The simplest repetitive and routine semiskilled jobs can be picked up in a day and mastered in a few weeks. Even those semiskilled jobs which require a higher degree of skill can be learned in a few months.

Semiskilled jobs often pay fairly well. Unlike the skilled worker, the semiskilled worker does not need to invest many years of his life learning a trade, but frequently this is a disadvantage. Because of his limited training, he is less valuable to employers and thus may have lower earnings and less job security. However, the semiskilled worker can move easily to new opportunities as they arise. Should the chances for employment disappear in one field of work, as often happens when a new process displaces an existing one, the semiskilled man can, in a brief period of training, learn a new semiskilled occupation.

A semiskilled worker should have some familiarity with different types of work, such as metalworking, woodworking, welding, or electrical work, rather than acquire intensive training in one type of work. He does not need to attain proficiency in any one of these fields, but does need a familiarity with the different types of processes and machines used in industry so that he can adapt readily to them.

During the past several decades, because of the great expansion that has occurred in those industries (particularly manufacturing) which require large numbers of semiskilled workers, this group of workers has become the largest in the labor force. Between 1910 and 1950, employment of semiskilled workers more than doubled.

The marked employment expansion in semiskilled occupations has been largely the result of varied developments in industrial technology. For example, the widespread mechanization of manufacturing processes since the turn of the century, particularly in the 1920's and 1930's, led to the subdivision of many skilled hand trades into a series of routine, repetitive machine operations which could be performed by semiskilled workers having relatively brief training. The development of new, giant, mass-production industries such as automobile manufacturing also created large numbers of semiskilled assembly jobs which previously had no counterparts. Finally, the continuing increase in the use of automobiles, trucks, buses, tractors, and other vehicles stimulated the employment of workers in certain semiskilled occupations, such as truckdriver, bus driver, taxicab driver, and deliveryman and routeman.

In recent years, industry has increasingly introduced new and improved types of automatic and semiautomatic devices which take over the work of many semiskilled workers in operations such as the simple tending of machines. Although these technological developments are expected to slow down the rate of employment growth of the semiskilled group in the 1960's, there will undoubtedly be a significant increase in semiskilled jobs, particularly those in manufacturing industries. Employment of semiskilled workers will rise as a result of the overall expansion of the economy generally, the increasing substitution of power equipment for unskilled manual labor, and the creation of new semiskilled jobs by our changing industrial technology. The introduction of automatic machinery and equipment in factories and other business establishments has been, and is expected to be, a long-run, gradual process which will not have severe adverse effects on the employment of semiskilled workers.

In addition to the job opportunities for semiskilled workers which will arise from the growth of this group, there will also be a need for tens of thousands of semiskilled workers each year to replace those who retire, die, are promoted, or transfer out of semiskilled jobs each year during the 1960's.

Unskilled laborers work in manual occupations which generally require no special training. In such jobs, the laborer performs elementary duties that may be learned in a few days and that require the application of little or no independent judgment. Unskilled manual jobs vary from those involving a minimum of physical exertion to those requiring heavy physical work. Frequently, these jobs involve manual handling and moving of heavy objects or materials, as in work that requires loading or unloading, digging, shoveling, hauling, hoisting, wrapping, and mixing. Unskilled manual laborers are employed mainly in manufacturing plants, construction work, wholesale and retail trade, and transportation jobs.

Over the past several decades, employment of unskilled laborers (excluding those on the farms and in the mines) has dropped. In recent years, employment of laborers has remained about stable. In 1958, employment of unskilled laborers was approximately 3.6 million and made up only about 5.6 percent of the Nation's work force.

The long-run decline in the employment of unskilled workers has occurred largely because of industry's increasing use of many types of mechanized equipment as a substitute for manual labor. For example, there has been a greatly increased use of power-driven, material handling equipment, such as forklift trucks, derricks, cranes, hoists, and conveyor belts, in factories, freight terminals, and warehouses, and in construction operations.

The substitution of mechanical equipment for unskilled labor in industry is expected to continue in the 1960's. However, total employment in this occupational group probably will show little change, mainly because requirements for unskilled laborers in expanding industries are expected to about offset the drop in the employment of such workers resulting from continuing mechanization.

BUILDING TRADES

The largest group of skilled workers in the American labor force is employed in the building trades. Altogether, there were almost 3 million building trades craftsmen in mid-1958—about one-third of all the skilled workers in the United States. The more than two dozen skilled building trades vary greatly in size, with the great majority of the skilled building craftsmen employed in six major trades—carpenter, painter, plumber and pipefitter, bricklayer, operating engineer, and construction electrician—each with over a hundred thousand workers. (See table 1.) The estimated 1.2 million carpenters alone accounted for slightly more than 40 percent of all skilled building trades workers. By contrast, only a few thousand workers were employed in each of several trades such as marble setter, terrazzo worker, tile setter, and stonemason.

There are several reasons why young men should consider one of the building trades as a career. These trades offer especially good opportunities for those who are not planning to go to college but who are willing to spend several years in learning a skilled occupation. Well-trained building trades craftsmen can find job opportunities in all parts of the country. Their hourly wage rates generally are much higher than those of most other manual workers. Journeymen (skilled workers) with business ability have greater opportunities to establish their own business than workers in many other skilled occupations. Moreover, employment in most building trades has expanded during the past several decades, and is still growing, despite advances in technology.

TABLE 1. *Estimated employment in selected skilled building trades, mid-1958*

Trade	Approximate number of workers (in thousands)	Percent of total
Total building trades employment	2, 900. 0	100. 0
Carpenters	1, 200. 0	41. 3
Painters	400. 0	13. 8
Plumbers and pipefitters	315. 0	10. 9
Bricklayers	250. 0	8. 6
Operating engineers	190. 0	6. 6
Electricians (construction)	130. 0	4. 5
Structural-, ornamental-, and reinforcing-iron workers	90. 0	3. 1
Plasterers	67. 5	2. 3
Roofers	58. 0	2. 0
Cement finishers	45. 0	1. 6
All other	154. 5	5. 3

SOURCE: Bureau of Labor Statistics.

A principal disadvantage of work in the building trades is the sharp employment fluctuations that result from changes in general business conditions. In the past, declines in building trades employment have been much greater than those in most other industries. Another disadvantage is that even during years of high levels of construction activity, annual earnings of workers in the building trades are somewhat limited by the seasonal nature of construction work. Time is lost as a result of bad weather and other interruptions. In addition, construction jobs generally are of short duration and building craftsmen must spend time in finding their next job. Continually changing, and sometimes inconvenient, places of employment are other disadvantages.

What Are the Building Trades?

Building trades craftsmen are skilled workers employed mainly in the construction, maintenance, repair, and alteration of homes and other types of buildings, highways, airports, and other structures. The wide range of materials and skills used in construction work has permitted specialization of various work operations. Thus, building trades workers who use essentially the same materials or skills have tended to become identified with distinctive trades: For example, bricklayers and stonemasons work with masonry materials. Although operating engineers do not work with particular materials, they have a group of related skills which enables them to handle various types of excavating, grading, hoisting, and other equipment.

The building trades consist primarily of journeymen who generally must have a high level of skill and a sound knowledge of assembly and construction operations. They are often assisted in their work by apprentices, tenders, and laborers.

The work of journeymen may be grouped into three broad classifications—structural, finishing, and mechanical. However, some craftsmen—for example, carpenters—may do finishing as well as structural work. Generally, each building trade is classified in one of these three categories, as follows:

Those occupations mainly concerned with structural work are: carpenter, bricklayer, stonemason, cement or concrete mason, structural-iron worker, ornamental-iron worker, reinforcing-iron worker (rodman), rigger, boilermaker, and operating engineer.

Those occupations mainly concerned with finishing work are: Lather, plasterer, marble setter, tile setter, terrazzo worker, painter, paperhanger, soft-floor layer, glazier, roofer, and asbestos worker.

Those occupations mainly concerned with mechanical work are: Plumber and pipefitter, millwright, construction electrician, sheet-metal worker, and elevator constructor.

All but a few of these skilled trades are described individually, later in this chapter. These descriptions are necessarily brief and incomplete. They do not apply fully to all localities because of local differences in the scope of the various trades. Also, they are not statements or recommendations concerning the work jurisdiction of these trades and are inappropriate for use in jurisdictional negotiations or the settlement of jurisdictional disagreements.

Where Building Trades Workers Are Employed

Building trades workers are employed mainly by contractors in the contract construction industry. Many others are employed to do maintenance work in industries other than construction, particularly manufacturing. Some building trades craftsmen work directly for business firms or government agencies which have their own construction work force; others are self-employed.

The building trades craftsmen who work in the contract construction industry are employed by general and special-trade contractors. General contractors may be classified as building (residential, commercial, or industrial), highway, or heavy construction contractors, since most general contractors limit their operations to one of these activities. They construct buildings and other structures, such as dams, bridges, and roads, taking full responsibility for the complete job, except for any specified portions of the work that may be omitted from the general contract. General contractors do a large part of the work with their own crews, but they often subcontract particular phases of the construction job to special-trade contractors.

Special-trade contractors usually do the work of only one trade, such as painting, carpentry, or electrical work, or of two or more closely related trades, such as plumbing and heating, or plastering and lathing. Beyond fitting their work to that of other trades, they have no responsibility for the structure as a whole. The special-trade contractors obtain orders for their work from general contractors, architects, or from property owners. Repair work is almost always done on direct order from the owners, occupants, architects, or rental agents.

There are several hundred thousand contractors (both general and special-trade), most of them operating in local areas. The great majority of them are small—generally employing fewer than 10 workers. However, some firms are large—employing several thousand workers each.

Many building trades workers are self-employed. Self-employed journeymen work directly for property owners on small jobs. They may be paid by the hour or the day, or they may be paid an agreed price for the job, either providing the materials and including them in the price or using materials provided by the owner. Self-employment is most common in carpentry and painting, but is found also in other skilled building trades.

In some of the trades, work may be performed away from the construction site. For example, sheet-metal workers may be employed in shops where ducts are fabricated for installation in a building. Many building trades craftsmen are also employed to do maintenance work in factories, stores, mines, hotels, and almost every other type of large business establishment.

The work of skilled building craftsmen is identified with a specific trade, such as carpentry or bricklaying, rather than with an individual contractor or even a broad group of contractors. Thus, a carpenter may be employed mainly by a particular builder but, in the course of a year, he may be employed also by a concrete contractor to build forms for a concrete bridge; by an electrical or plumbing contractor to build a temporary structure at a large construction site; or he may contract to do a small repair job on his own.

The fact that building trades craftsmen are employed in almost every community, is an important consideration for young persons interested in a career in the skilled building trades. Once they learn one of the trades they can find jobs not only in their own community but in almost any part of the country. Employment of these workers is distributed geographically, however, in much the same way as the Nation's population. Thus, their employment is concentrated generally in the industrialized and highly populated States, such as California, New York, Pennsylvania, Illinois, Ohio, and Texas.

Training, Other Qualifications, and Advancement

Apprentice training under a formal apprenticeship agreement registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training is considered by training authorities generally to be the best way to acquire the all-round proficiency of a skilled building trades worker. Apprenticeship is a prescribed period of on-the-job training supplemented by related trade instruction which is designed to develop skill by making the apprentice familiar with the materials, tools, and principles of his trade. It provides him with a balanced knowledge of his field of work and enables him to perform its operations competently.

In addition to the apprenticeship method, many building trades craftsmen have learned their trades informally. Most of these workers have picked up a trade through several years of on-the-job experience. Generally, they first worked as laborers and helpers and learned the skills of a trade by working with and observing the work of experienced craftsmen. Some building trades craftsmen have acquired their skills, or part of their skills, by attending vocational or trades schools.

Generally, apprentices in the building trades are required to be between the ages of 17 and 25, and in good physical condition. A high school education or its equivalent, with course work in mathematics and the sciences, is desirable. Often, applicants are given tests to determine their aptitude for a particular occupation. For some skilled building trades, it is important to have considerable manual dexterity, mechanical aptitude, a discerning color sense, and an eye for quickly determining proper alinement of materials.

The formal registered apprenticeship agreement generally stipulates a training period of 3 to 5 years of relatively continuous employment and training, in addition to a minimum of at least 144 hours a year of related classroom instruction. The journeymen on the job and the foreman explain to the apprentice how the work is done and show him how different operations are performed and how different tools are used. Ordinarily, most of this instruction is given by a particular journeyman to whom the apprentice is assigned. The apprentice is required to do work of progressively increasing difficulty and with progressively less supervision.

Related classroom instruction varies among the skilled building trades, but usually includes courses such as: History of the trade; characteristics of the materials used; shop mathematics as related to the work of the trade; some basic principles of engineering where appropriate (particularly for pipework, ventilating systems, and electrical work); sketching, elementary drafting, and interpretation of drawings; safety practices; and special-trade theory such as color harmony for painters and elementary sanitation for plumbers. Such related instruction is seldom offered in small communities where there may be only a few apprentices and a small number of journeymen in a particular trade. In these areas, apprentices receive instruction through courses offered in the local high school or by visiting instructors, generally furnished by the State. Other subject matter requirements are met through personal instruction by local journeymen and contractors or, in some cases, by correspondence courses.

The formal registered apprenticeship agreements also recommend the length of time the apprentice is required to work in each major operation of the trade as well as his rate of pay at successive intervals of advancement. The apprentice is paid at an advancing rate, usually starting at 50 percent of the journeyman's pay. The apprentice's rate increases at 6-month or 1-year intervals until a rate of about 90 percent of the journeyman's rate is reached in the final months of training. Often, advanced apprenticeship standing and pay are given to apprentices who have acquired trade skills in the Armed Forces, or through trade school instruction. Advanced standing is granted on an individual basis and is usually determined by a demonstration of trade skill and knowledge.

In most communities, the apprenticeship programs are supervised by joint apprenticeship committees composed of representatives of the local employers or employer groups and the union local. In these cases, the apprentices sign their apprenticeship agreements with these committees. The committee determines the need for apprentices in the locality and establishes minimum apprenticeship standards of education, experience, and training. Where employers cannot provide the variety of experience necessary to give an apprentice all-round instruction in the various branches of the trade, or relatively continuous employment over the entire period of apprenticeship, the committee transfers the apprentice to another employer. Where specialization by contractors is extensive—for instance, in electrical work—it is customary for the joint committee to rotate apprentices among several contractors in the trade at intervals of about 6 months. In some large cities the local, joint apprenticeship committee employs a coordinator to supervise the apprenticeship program.

In areas where these committees have not been established, the apprenticeship agreement is solely between the apprentice and an employer or employer group. Many journeymen have received worthwhile training under these types of apprenticeship programs, but these programs may involve some element of risk for the apprentice. In such instances, there is no joint committee to supervise the training offered, to settle differences over the terms and conditions of apprentice training, or to arrange a transfer in cases of personal disagreements between the apprentice and the employer. The apprentice's training depends principally on his employer's business prospects and policies. If the employer lacks continuous work or does only a restricted type of work, he cannot provide the apprentice with the all-round training needed to develop journeyman skills.

In many localities craftsmen, most commonly construction electricians and plumbers, are required to have a journeyman's license to work at their trade. To qualify for these licenses, they must pass an examination, showing a well-rounded knowledge of the job and of State and local regulations. (More detailed information concerning the training, other qualifications, and advancement of building trades workers is given later in this chapter in the discussion of the individual occupations in the building trades.)

Building trades craftsmen may advance in a number of ways. For example, a journeyman may become a foreman in charge of his employer's crew. In most localities, small jobs are run by "working foremen" who work at the trade along with members of their own crews except when engaged in supervisory or management duties. On very large jobs, the foremen do no actual production work. A craftsman can also become an estimator for a contractor. In this job, he estimates material requirements and labor costs in order to enable the contractor to bid on the work of a particular construction project. Some craftsmen advance to jobs as superintendents on large projects. Other craftsmen become instructors in trade and vocational schools, or salesmen for building supply companies.

In addition, many thousands of journeymen have become contractors, particularly in the homebuilding field. Sound journeyman knowledge is a great help in assuring success as a contractor. However, the successful contractor must also have the ability to plan work, to foresee needs and problems, to direct others, to estimate material and time requirements for jobs on which he is bidding. He also must have a sound knowledge of business practices and financing.

Generally, it is easier to start a small contracting business in the construction industry than it is to start a small business in other industries. For example, only relatively moderate financial investment is needed, liberal credit arrangements make it easier to buy materials, and it is possible to conduct a fairly substantial business from the proprietor's home. Because it is relatively easy to enter the contracting business, competition is usually keen, especially for smaller jobs. For larger jobs, considerable working capital and investment in equipment are necessary. Some States or municipalities require contractors to be licensed.

Employment Outlook

A continued upward trend in the employment of skilled building trades workers is expected during the 1960's. The rate of employment increase for these craftsmen is expected to be much greater than the estimated 20-percent increase anticipated for the Nation's total working population. In addition to openings resulting from an increase in employment, thousands of job opportunities for new workers to enter the building trades will result each year from the need to replace skilled workers who retire, die, transfer to other fields of work, or are promoted to other jobs.

The favorable employment prospects for these skilled workers will result primarily from the expected large rise in the level of construction activity, continuing the post-World War II trend. The postwar construction trend can best be illustrated by an examination of construction expenditures. Total construction expenditures (including maintenance and repair) more than tripled from 1946 to 1958 (actual expenditures not adjusted for changes in price levels). The rate of growth for new construction during the same period was even greater. Expenditures for maintenance and repairs more than doubled. The post-World War II growth of the construction industry can also be seen in the increase in construction employment. For example, in contract construction, which employs a majority of the skilled building craftsmen, employment rose from 1.7 million in 1946 to about 2.7 million in 1958, or about 60 percent.

The same factors which accounted for the rapid postwar expansion in construction activity are expected to result in a further growth of perhaps 40 to 50 percent during the 1960's. These factors include anticipations of large increases in population and in the number of households; a continuing shift of families from the cities to the suburbs; increases in governmental expenditures for highways, schools, and defense; a rise in expenditures for new industrial plant capacity; higher levels of personal and corporate income; and expanding demand for maintenance repair, and modernization work.

This large rise in construction activity is expected to result in a substantial increase in the employment of building trades craftsmen. However, employment is expected to increase at a slower rate than expenditures. Continued technological developments in construction methods and equipment will permit greater output per construction worker. The technological changes which can be foreseen at the present time will likely have limited effects on employment in the large building trades. The experience of the past 50 years shows that the skilled building trades generally have been able to adapt to technological changes and still continue to grow.

Employment of building trades craftsmen in maintenance jobs in factories, commercial establishments, schools, and large residential projects is also expected to increase substantially in the 1960's.

The rate of growth will differ among the various building trades. Employment growth will be most rapid for operating engineers, cement finishers, construction electricians, sheet-metal workers, and bricklayers and least rapid for painters, paperhangers, stonemasons, tile and marble setters, and building laborers. Employment of carpenters will also increase substantially and this trade will continue to be the largest single occupation in the building trades. (A more complete statement covering employment opportunities in each trade is given in the discussions of individual occupations in this chapter.)

One of the principal sources of job opportunities for new workers will result from replacement needs. The building trades, with almost 3 million skilled craftsmen in mid-1958, is a very large field of work. Retirements and deaths alone will create about 60,000 to 70,000 job openings each year. Other openings will result from the need to replace experienced craftsmen who leave the building trades for other fields of work.

In early 1959, about 109,000 apprentices were in registered apprenticeship training programs in the construction trades and perhaps 20,000 to 30,000 other apprentices in programs which were unregistered. Opportunities for young men to receive apprenticeship training will be available in all parts of the country during the 1960's. In addition, thousands of other workers will be able to enter the construction trades informally.

Some indication of the location of future apprenticeship opportunities in the building trades is available from the latest data showing the geographical distribution of registered apprentices in these trades. The following eight States accounted for more than half of the number of registered apprentices in training for selected building trades, as of June 30, 1958: California, 12,358; Illinois, 9,913; New York, 8,463; Ohio, 8,155; Texas, 4,924; Pennsylvania, 4,418; Michigan, 4,274; and Florida, 3,549.

Earnings and Working Conditions

Hourly wage rates paid to building trades craftsmen are generally much higher than those paid to most other skilled workers. However, because construction work is seasonal and time is lost for other reasons, average annual earnings are not as high as the hourly rates of pay indicate. Nevertheless, annual earnings of these craftsmen, as a group, compare favorably with those of other skilled workers.

The hourly rates of pay for skilled workers in the building trades vary by trade and locality. Generally, the highest hourly rates are paid in the larger communities. (Wage rates for a trade may also vary within the same city, generally reflecting differences in the types of work performed and in working conditions.) The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades, as of July 1, 1958, showed the average rates for journeymen and for helpers and laborers in selected trades, for the 52 large cities surveyed, to be as follows:

	Minimum average hourly rate
All building trades	$3.34
Journeymen	3.54
Asbestos workers	3.64
Bricklayers	3.87
Carpenters	3.46
Cement finishers	3.43
Electricians	3.68
Elevator constructors	3.67
Glaziers	3.22
Lathers	3.72
Marble setters	3.62
Terrazzo workers	3.62
Tile setters	3.50
Painters	3.27
Paperhangers	3.24
Pipefitters	3.71
Plasterers	3.75
Plumbers	3.70
Roofers, composition	3.26
Roofers, slate and tile	3.37
Sheet-metal workers	3.54
Stonemasons	3.77
Structural-iron workers	3.62
Rodmen	3.51
Helpers and laborers	2.55
Bricklayers' tenders	2.68
Building laborers	2.47
Composition roofers' helpers	2.19
Elevator constructors' helpers	2.63
Marble setters' helpers	2.78
Terrazzo workers' helpers	2.89
Tile setters' helpers	2.75
Plasterers' laborers	2.85
Plumbers' laborers	2.42

Table 2 gives the union minimum hourly wage rates for selected building trades, in each of the 52 cities surveyed, as of July 1, 1958.

Union rates for these occupations are negotiated between trade unions and employers. They do not include overtime, bonuses, and payments for special qualifications or other reasons.

Forty hours was the standard workweek for a majority of building trades workers in 1958. Time and a half was generally paid for hours worked beyond the standard workday of 8 hours. Time-and-a-half or double-time rates were usually paid for work on Saturdays and Sundays or on holidays. Travel pay to and from work was commonly paid to building trades workers whenever their work was outside a specified local area.

A substantial proportion of organized building trades workers are included in health and insurance programs negotiated between unions and employers. A majority of the building trades workers in major cities are covered by health and insurance programs financed almost entirely by employer contributions. Pension plans for building trades workers have become more common in recent years.

A large proportion of skilled building trades workers are members of trade unions affiliated with the Building and Construction Trades Department of the American Federation of Labor and Congress of Industrial Organizations.

Construction work frequently requires prolonged standing, bending, stooping, and working in cramped quarters. Exposure to cold, hot, and inclement weather is common as much of the work is done outdoors or in partially enclosed structures. During the winter, when the buildings are sufficiently enclosed, artificial heat is commonly provided. Many persons prefer construction work to other skilled occupations because they can work outdoors.

TABLE 2. *Union minimum hourly wage rates in selected building trades in 52 large cities, as of July 1, 1958* [1]

City	Asbestos workers	Bricklayers	Carpenters	Cement finishers	Electricians (construction)	Elevator constructors	Glaziers	Lathers	Marble setters	Terrazzo workers	Tile setters	Operating engineers	
												Bulldozers	Shovels
Atlanta, Ga	$3.25	$3.75	$3.05	$3.00	$3.35	$3.32	$2.75	$3.25	$3.45	$3.45	$3.45	$2.85	$3.38
Baltimore, Md	3.73	3.80	3.20	3.25	3.58	3.57	3.10	3.45	3.55	3.34	3.34	3.00	3.80
Birmingham, Ala	3.40	3.75	2.95	2.91	3.43	3.37	2.85	2.83	3.35	3.35	3.35	2.93	2.93
Boston, Mass	3.57	3.75	3.40	3.84	3.45	3.54	3.00	3.75	3.70	3.70	3.70	3.40	3.78
Buffalo, N.Y	3.30	3.80	3.74	3.56	3.90	3.80	3.10	3.86	3.54	3.48	3.48	----------	3.64
Charlotte, N.C	3.15	3.10	2.40	2.38	2.90	--------	2.00	3.13	3.00	3.00	3.00	2.60	2.90
Chicago, Ill	3.75	3.83	3.65	3.65	3.90	3.85	3.89	3.71	3.85	3.65	3.65	3.15	3.75
Cincinnati, Ohio	3.45	3.70	3.58	3.43	3.82	3.62	3.50	3.58	3.85	3.55	3.55	3.38	3.60
Cleveland, Ohio	3.83	3.84	3.83	3.83	3.95	3.73	3.58	3.89	3.63	3.47	3.57	3.58	3.83
Columbus, Ohio	3.57	3.80	3.32	3.17	3.60	3.43	2.90	3.50	3.23	3.23	3.23	3.38	3.60
Dallas, Tex	3.33	3.88	3.10	3.10	3.38	3.50	2.92	3.56	3.00	3.00	3.00	3.25	----------
Dayton, Ohio	3.47	3.71	3.33	3.17	3.63	3.62	3.13	3.50	3.44	3.44	3.44	3.35	3.63
Denver, Colo	3.55	3.75	3.34	3.34	3.60	3.46	2.87	3.48	3.45	3.45	3.45	----------	3.05
Des Moines, Iowa	3.25	3.93	3.25	3.30	3.50	3.53	2.85	3.35	3.25	3.25	3.25	----------	3.38
Detroit, Mich	3.85	3.77	3.40	3.05	3.80	3.60	3.10	3.55	3.64	3.63	3.63	3.35	3.35
Erie, Pa	--------	3.90	3.49	3.15	3.68	3.50	3.00	3.82	3.64	3.64	3.64	3.13	3.60
Grand Rapids, Mich	3.55	3.95	3.30	3.23	3.46	3.55	2.84	3.62	3.95	3.45	3.45	3.28	3.38
Houston, Tex	3.63	3.75	3.08	3.10	3.65	3.49	2.93	3.50	3.55	3.55	3.55	3.30	----------
Indianapolis, Ind	3.50	3.80	3.38	3.18	3.65	3.63	3.41	3.50	3.55	3.65	3.55	3.40	----------
Jacksonville, Fla	3.23	3.35	2.85	2.52	3.45	3.28	2.55	3.20	3.15	3.15	3.15	2.95	3.15
Kansas City, Mo	3.57	3.85	3.33	3.33	3.48	3.47	3.25	3.38	3.58	3.58	3.58	----------	3.10
Knoxville, Tenn	3.35	3.65	2.88	2.76	3.15	3.27	2.40	3.18	3.65	3.65	3.65	2.78	3.03
Little Rock, Ark	3.30	3.50	2.95	2.85	3.13	3.20	2.65	3.30	3.00	3.00	3.00	2.90	3.10
Los Angeles, Calif	3.70	3.85	3.38	3.30	3.98	3.87	3.29	4.10	3.55	3.63	3.50	3.71	3.81
Louisville, Ky	3.45	3.85	3.30	3.30	3.55	3.49	2.93	3.40	3.40	3.40	3.40	3.38	3.38
Memphis, Tenn	3.40	3.75	2.95	2.80	3.30	3.31	2.65	2.72	3.20	3.20	3.20	2.73	2.98
Milwaukee, Wis	3.56	3.65	3.40	3.13	3.35	3.37	3.15	3.41	3.51	3.46	3.38	3.11	3.50
Minneapolis-St. Paul, Minn	3.37	3.73	3.30	3.40	3.38	3.46	2.85	3.30–3.25	3.27	3.30	3.12	3.15	3.37–3.47
Newark, N.J	3.95	4.30	4.15	4.30	4.25	4.24	3.83	4.00	----------	4.10	3.73	----------	4.60
New Haven, Conn	3.75	3.65	3.35	3.65	3.50	3.53	--------	3.50	3.65	3.65	3.65	3.00	3.50
New Orleans, La	3.40	3.48	2.95	2.90	3.48	3.23	2.85	3.00	3.48	3.05	3.05	2.43	----------
New York, N.Y	4.30	4.35	4.10	4.20	3.90	4.24	4.10	4.00	3.95	4.10	3.73	3.73	4.60
Oklahoma City, Okla	3.45	3.80	2.98	3.10	3.50	3.52	2.75	3.50	3.35	3.35	3.35	2.80	2.80
Omaha, Nebr	3.50	3.70	3.25	3.18	3.58	3.41	2.90	3.50	3.15	3.15	3.15	2.75	3.05
Peoria, Ill	3.75	3.93	3.50	3.50	3.70	3.60	3.22	3.40	3.85	3.85	3.85	3.60	----------
Philadelphia, Pa	3.93	4.00	3.64	3.63	4.08	4.04	3.35	3.93	3.75	3.81	3.63	3.42	4.10
Pittsburgh, Pa	3.98	4.15	3.31	3.65	4.35	3.81	3.40	3.58	3.48	3.85	3.45	3.54	3.74
Portland, Oreg	3.45	3.65	3.10	3.15	3.50	3.43	3.04	3.40	3.50	3.15	3.35	----------	3.41
Providence, R.I	3.55	3.60	3.08	3.20	3.40	3.45	3.05	3.60	3.35	3.35	3.35	----------	3.70
Richmond, Va	3.13	3.50	2.60	2.50	3.15	3.22	1.90	3.00	3.13	3.13	3.13	2.50	3.00
Rochester, N.Y	3.50	3.84	3.55	3.64	3.67	3.71	3.07	3.57	3.69	3.69	3.69	3.32	3.69
St. Louis, Mo	3.68	3.90	3.58	3.88	3.83	3.79	3.85	3.55	3.55	3.77	3.35	----------	3.68
Salt Lake City, Utah	3.54	3.77	3.08	3.05	3.28	3.21	2.56	3.38	3.13	3.13	3.13	----------	3.10
San Antonio, Tex	3.32	3.50	3.00	2.88	3.38	3.32	2.75	3.50	2.75	2.75	2.75	3.25	--------
San Francisco-Oakland, Calif	3.70	3.95–3.75	3.33	3.37	3.91	3.74	3.24	3.44–3.84	3.57	3.30	3.50	----------	3.70–3.95
Scranton, Pa	3.38	3.63	3.05	3.38	3.35	3.58	2.70	3.53	3.63	3.63	3.63	3.31	3.99
Seattle, Wash	3.46	3.90	3.13	3.23	3.65	3.51	3.11	3.40	3.55	3.50	3.50	3.26	3.63
Spokane, Wash	3.31	3.89	3.13	3.23	3.58	3.54	2.84	3.45	3.72	3.61	3.61	----------	3.30
Springfield, Mass	3.50	3.53	3.20	3.53	3.38	3.45	3.15	3.20	3.53	3.53	3.53	2.95	3.40
Syracuse, N.Y	3.55	3.73	3.35	3.43	3.70	3.53	2.75	3.60	3.45	3.45	3.45	3.15	3.70
Toledo, Ohio	3.68	3.83	3.72	3.72	3.80	3.66	3.15	3.72	3.83	3.55	3.55	3.44	3.72
Washington, D.C	3.85	3.50	3.50	3.43	3.90	3.81	3.28	3.75	3.93	3.68	3.68	3.20	3.70

See footnotes at end of table.

Table 2. *Union minimum hourly wage rates in selected building trades in 52 large cities, as of July 1, 1958* [1]—Continued

City	Painters	Paper-hangers	Plaster-ers	Plumb-ers	Pipe-fitters	Roofers: Com-posi-tion	Roofers: Slate and tile	Sheet-metal workers	Stone-masons	Struc-tural-iron work-ers [2]	Rod-men	Brick-layers' tenders	Building laborers
Atlanta, Ga.	$3.00	$3.25	$3.25	$3.45	$3.45	$2.40	$2.65	$3.35	$3.75	$3.30	$3.15	$1.70	$1.70
Baltimore, Md.	2.98	2.98	3.45	3.40	3.40	2.70	3.10	3.30	3.80	3.75	3.50	2.15	2.00
Birmingham, Ala.	3.00	3.00	3.05	3.32	3.32	2.65	2.65	3.30	3.75	3.35	3.35	1.65	1.65
Boston, Mass.	3.10	----	3.65	3.40	3.50	3.40	3.40	3.40	3.75	3.90	3.90	2.55	2.55
Buffalo, N.Y.	3.35	3.35	3.75	3.58	3.65	3.33	3.48	3.63	3.80	3.65	3.65	2.74	2.74
Charlotte, N.C.	2.00	2.35	2.63	3.10	3.10	----	----	2.83	----	3.00	2.75	1.34	1.34
Chicago, Ill.	3.50	3.50	3.70	3.73	3.75	3.96	3.96	3.75	3.83	4.00	4.00	2.78	2.78
Cincinnati, Ohio	3.05	3.10	3.63	3.73	3.80	3.43	3.63	3.65	3.85	3.60	3.45	----	2.63
Cleveland, Ohio	3.51	3.51	3.83	3.73	3.73	3.83	3.83	3.83	3.84	3.73	3.73	3.09	3.09
Columbus, Ohio	3.05	3.05	3.50	3.55	3.55	3.38	3.38	3.43	3.55	3.55	3.55	2.62	2.42
Dallas, Tex.	2.50	3.13	3.56	3.38	3.38	2.60	2.75	3.38	3.88	3.30	3.05	1.85	1.70
Dayton, Ohio	3.20	3.47	3.43	3.65	3.65	3.16	3.38	3.38	3.71	3.50	3.43	2.65	2.38
Denver, Colo.	3.08	3.08	3.38	3.55	3.55	3.20	3.20	3.65	3.75	3.26	3.26	2.50	2.17
Des Moines, Iowa	3.00	3.00	3.38	3.56	3.56	2.77	2.77	3.25	3.93	3.30	3.30	2.50	2.50
Detroit, Mich.	3.25	3.25	3.66	3.74	3.74	3.59	3.94	3.54	3.77	3.60	3.19	2.58	2.58
Erie, Pa.	3.04	3.04	3.40	3.65	3.65	2.95	2.95	3.58	3.90	3.64	3.64	2.65	2.55
Grand Rapids, Mich.	2.80	3.05	3.40	3.70	3.70	2.85	3.10	3.10	3.95	3.74	3.48	2.50	2.50
Houston, Tex.	3.00	3.00	3.50	3.43	3.55	2.88	3.38	3.38	3.75	3.13	2.88	2.03	1.85
Indianapolis, Ind.	3.30	3.30	3.60	3.60	3.60	2.93	3.18	3.48	3.80	3.48	3.48	2.57	2.38
Jacksonville, Fla.	2.63	2.88	3.05	3.50	3.50	2.75	2.75	3.05	3.35	3.20	3.00	1.52	1.20
Kansas City, Mo.	3.25	3.25	3.63	3.50	3.50	3.03	3.03	3.55	3.55	3.40	3.25	2.55	2.36
Knoxville, Tenn.	2.70	----	3.25	3.30	3.30	2.38	2.43	3.15	----	3.15	3.05	----	1.78
Little Rock, Ark.	2.60	2.60	3.30	3.20	3.20	2.25	2.50	2.95	3.50	3.05	2.95	1.75	1.50
Los Angeles, Calif.	3.36	3.61	4.00	3.80	3.80	3.00	3.00	3.70	3.85	3.63	3.38	2.93	2.68
Louisville, Ky.	3.15	2.25	3.40	3.45	3.45	2.70	3.28	3.40	3.85	3.45	3.45	2.60	2.25
Memphis, Tenn.	2.87	2.87	3.22	3.41	3.41	2.35	2.68	3.10	3.75	3.05	3.00	1.75	1.60
Milwaukee, Wis.	3.00	----	3.31	3.36	3.36	3.05	3.20	3.20	3.65	3.32	3.32	2.73	2.62
Minneapolis-St. Paul, Minn.	3.15	3.15	3.40	3.22	3.22	3.30	3.30	3.28-3.15	3.73	3.47	3.37	2.65-2.55	2.55
Newark, N.J.	3.60	----	4.30	4.25	4.25	4.05	4.20	4.10	4.30	4.55	4.55	3.25	3.35
New Haven, Conn.	3.10	3.60	3.65	3.50	3.50	3.63	3.88	3.50	3.65	3.95	3.95	2.60	2.60
New Orleans, La.	2.63	2.63	3.07	3.40	3.40	2.92	2.92	3.09	3.48	3.25	2.95	1.80	1.70
New York, N.Y.	3.29	----	4.35	4.10	4.30	3.85	4.45	4.10	4.25	4.40	4.20	3.35	3.35
Oklahoma City, Okla.	2.90	2.90	3.50	3.57	3.57	2.80	2.80	3.20	3.80	3.25	3.25	2.20	2.05
Omaha, Nebr.	2.80	2.80	3.50	3.50	3.50	2.58	2.83	3.10	3.70	3.35	3.35	2.23	2.23
Peoria, Ill.	3.23	3.23	3.78	3.75	3.75	3.41	3.41	3.73	3.93	3.70	3.70	2.85	2.85
Philadelphia, Pa.	3.18	3.14	4.05	4.00	4.10	3.45	3.86	3.94	3.50	4.18	4.10	2.10	2.10
Pittsburgh, Pa.	3.45	3.45	3.83	4.00	4.00	3.48	3.48	3.98	4.15	3.80	3.58	2.70	2.45
Portland, Oreg.	3.08	3.20	3.40	3.49	3.49	3.25	3.25	3.30	3.65	3.40	3.20	2.95	2.55
Providence, R.I.	2.70	2.70	3.55	3.35	3.35	3.05	3.25	3.25	3.60	3.80	3.80	2.38	2.38
Richmond, Va.	2.25	2.25	3.12	3.25	3.25	----	----	3.05	3.50	3.15	2.90	1.55	1.40
Rochester, N.Y.	3.30	3.30	3.84	3.47	3.47	3.29	3.29	3.38	3.84	3.68	3.68	2.72	2.72
St. Louis, Mo.	3.42	3.42	3.80	3.85	3.93	3.50	3.50	3.10	3.90	3.60	3.60	3.00	2.38
Salt Lake City, Utah	2.86	2.86	3.38	3.35	3.35	3.00	3.00	3.00	----	3.13	3.13	2.70	2.20
San Antonio, Tex.	2.75	2.75	3.50	3.43	3.43	2.15	2.50	3.31	3.50	3.25	3.00	1.49	1.38
San Francisco-Oakland, Calif.	3.35	3.35	3.74-3.54	3.82-3.88	3.82-4.21	3.35	3.35	3.63-3.65	3.95-3.75	3.63	3.38	3.15-3.10	2.69
Scranton, Pa.	2.63	2.63	3.53	3.35	3.35	3.05	3.05	3.05	3.63	4.30	4.20	2.48	2.33
Seattle, Wash.	3.14	3.14	3.40	3.70	3.70	3.23	3.48	3.48	3.90	3.40	3.20	3.00	2.70
Spokane, Wash.	3.00	3.00	3.45	3.70	3.70	3.10	3.10	3.47	3.89	3.40	3.20	2.75	2.40
Springfield, Mass.	2.90	2.90	3.53	3.35	3.35	3.20	3.38	3.50	3.53	3.88	3.88	2.55	2.28
Syracuse, N.Y.	3.00	3.00	3.60	3.51	3.58	3.50	3.50	3.58	----	3.68	3.68	2.58	----
Toledo, Ohio	3.39	3.39	3.72	3.75	3.75	3.56	3.56	3.56	3.83	3.72	3.69	2.97	2.84
Washington, D.C.	3.47	3.47	3.65	3.76	3.81	2.70	3.20	3.81	3.93	4.00	3.70	----	1.95

[1] The ranges of wage scales which are shown for individual buiding trades in some areas represent different rates or scales for two cities in an area.

[2] Wage scales for ornamental-iron workers generally are the same as for structural-iron workers.

Construction work is generally more dangerous than work in manufacturing, but the risk of injury is lessened considerably when proper work practices are followed. In recent years, the safety record of construction workers in contract construction work has improved as a result of safety programs established by employers and unions.

Where To Go for More Information

Information on opportunities for apprenticeship or other types of construction employment in a particular locality may be obtained from individual construction firms, employer associations, or locals of the building trades unions. Many apprenticeship programs are supervised by local, joint union-employer apprenticeship committees. In these instances, an apprentice applicant may apply directly to the coordinator of the joint apprenticeship committee if there is one in his locality. In recent years, there has been a trend toward increased use of the local office of the State employment service as a source of information and a contact point for apprenticeship openings.

For more information on jobs in the building trades, a young man should write to the organizations listed below:

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department,
815 16th St. NW., Washington 6, D.C.

Associated General Contractors of America, Inc.,
1957 E St. N.W., Washington 6, D.C.

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

For the names of labor organizations and trade associations concerned with specific building trades, see the discussions of individual building trades later in this chapter.

Carpenters

(D.O.T. 5–25.110 through .840)

Nature of Work

Carpentry is the largest single building trade in terms of employment. Carpenters are needed in almost every type of construction activity. For example, they do the framing of houses and other types of structures, make the forms needed to hold cement, and do finishing operations such as the installation of interior and exterior wood trim on houses.

As part of their job, carpenters saw, fit, and assemble wood, plywood, wallboard, and other materials. They fasten these materials by means of nails, bolts, wood screws, or glue to form various structures. They may also install linoleum, asphalt tile, and similar soft-floor coverings. They use handtools such as hammers, saws, chisels, and planes, and power tools such as portable power saws, drills, and rivet guns.

Carpentry work is commonly divided into two broad categories—"rough" carpentry and "finish" carpentry. Skilled carpenters, however, are able to do both types of work. In rough work, carpenters erect the wood framework in buildings, including subflooring, sheathing, partitions, floor joists, studding, and rafters. They also install heavy timbers used in the building of docks, railroad trestles, and similar heavy installations. Rough carpentry also includes the building of forms to enclose concrete until it has hardened, the making of chutes for pouring wet concrete, and the erection of scaffolding and temporary buildings on the construction site. After the rough carpentry is completed, the finish-work carpenters install molding around floors and ceilings, wood paneling, cabinets, window sash, door frames, and hardware. They also build stairs and lay floors. Finish-work carpenters must be very accurate because their completed work is visible and because they often work with expensive woods.

Although a journeyman (skilled) carpenter is expected to know all aspects of carpentry work, there is much specialization within the trade because of the wide scope of the work performed. For example, some carpenters specialize in installing acoustic panels on ceilings and walls; others specialize in trimming (the installation of millwork and finish hardware), laying hardwood floors, or building stairs. Specialization is more common in the large cities; in small communities, carpenters ordinarily do all types of carpentry work. In rural areas, carpenters may also frequently do the work of other craftsmen, particularly painting, glazing, or roofing. Carpenters generally work in a particular field of construction, such as home, bridge, or highway construction, or industrial maintenance work.

Where Employed

Most carpenters work in the construction industry and are employed mainly by contractors and homebuilders at the construction site. They work principally on building construction, although many are employed on highway or other nonbuilding projects. A large number do repair, alteration, or modernization work. Many car-

Carpenter apprentices learn the trade through actual work experience.

penters alternate between wage employment for contractors and self-employment on small jobs. Many others work for government agencies or nonconstruction firms which employ a separate work force to do their own construction work. A large number of carpenters do maintenance work in factories, hotels, office buildings, and other large establishments. Carpenters are also employed in shipbuilding, in mining, and in the production of many kinds of display materials.

Carpenters are employed in almost every community in the country. The geographical distribution of employment in this occupation is similar to that in the building trades generally. (See discussion, p. 281.) The widespread employment of carpenters is an important consideration for young persons interested in learning this trade. Beginning carpenters can not only find jobs in their own communities but once they become journeymen they can obtain jobs in almost any part of the country.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprenticeship program for carpenters is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of carpenters, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing, or being taught by, experienced carpenters. Many of these persons have gained some of the knowledge of their trade by taking correspondence or trade school courses.

Apprenticeship applicants are generally required to be at least 17 years of age; a high school education or its equivalent is desirable. Good physical condition, a good sense of balance, and lack of fear of working on structures high off the ground are important assets. Aptitudes which the apprentice should have include manual dexterity and the ability to solve arithmetic problems quickly and accurately.

Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program generally consists of 8,000 hours (4 years) of on-the-job training, in addition to a minimum of 576 hours of related classroom instruction. During the apprenticeship period, the apprentice learns elementary structural design and becomes familiar with the common systems of frame and form construction. Because the work of the carpenter is basic in the construction process, the apprentice also learns the relationship between carpentry and the other building trades.

The following is a general summary of a typical 4-year apprenticeship carpenter program: Learns to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; learns to build forms for holding cement, rough framing, outside and inside finishing work, fitting of hardware, and layout of doors, windows, and partitions.

The apprentice also receives related classroom instruction in drafting and blueprint reading, mathematics applicable to layout work, and the use of woodworking machines.

Hourly wage rates for apprentices start at about 50 percent of the journeyman rate and usually increase by about 5 percent in each 6-month period until a rate of 85 to 90 percent is

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reached during the last period of apprenticeship. If apprentice applicants have had experience or training directly related to the trade, such as training in carpentry in a vocational school or experience in the Armed Forces, they may be given advanced apprenticeship standing.

Carpenters may advance to the position of carpenter foreman. In addition, they may become general construction foremen. Carpenters usually have greater opportunities than most building craftsmen to become general construction foremen since carpenters are more familiar with the entire construction process. The proportion of self-employed among carpenters is higher than among most other skilled building trades. Some self-employed carpenters are able to become contractors—hiring other journeymen. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of construction, are basic requirements for success as a contractor.

Employment Outlook

There will be tens of thousands of opportunities for young men to learn the carpentry trade during the 1960's. A substantial increase in the employment of these workers is expected as a result of anticipated higher levels of construction activity. In addition, replacement needs will create thousands of job opportunities for new workers.

Employment of carpenters has increased rapidly in recent years, with this rate of growth being much faster than that of the total labor force. The number of carpenters employed increased from about 550,000 in 1940 to 900,000 in 1950, and to about 1,200,000 in mid-1958. The anticipated 40 to 50 percent increase in construction expenditures in the 1960's (see discussion, p. 284), will result in continued growth in this occupation.

Technological developments have affected and are expected to continue to affect both the number and skill requirements of carpenters. Construction materials that are processed off the site and materials designed for easier and faster installations have become progressively more important. There has also been a continued trend toward a greater use of factory prefabrication of structural building components as well as entire structures. Nevertheless, a substantial increase in employment of carpenters in construction is anticipated. A growing number of carpenters will also be needed in the maintenance departments of factories, commercial establishments, large residential projects, and government agencies.

The 1.2 million carpenters comprise the largest single group of skilled workers in the country and account for about two-fifths of all building trades craftsmen. Because of the large size of this occupation, replacement needs are very great. Retirements and deaths alone will create about 25,000 to 30,000 job openings annually during the 1960's. Many other openings will result from the need to replace workers who leave the trade for other reasons.

Young men who obtain all-round skill training of the kind given under apprenticeship programs will have especially favorable long-range job prospects. These workers are in much greater demand than the many persons in the trade who can do only the simpler and more routine types of carpentry work. They also have better opportunities for advancement.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for carpenters was $3.46. Among the individual cities, the union minimum hourly wage rates for carpenters ranged from $2.40 in Charlotte, N.C., to $4.15 in Newark. (See table 2, p. 286, for union minimum hourly wage rates for carpenters, in each of the 52 large cities.)

Because of the seasonal nature of much of construction work and because of time lost for other reasons, the average annual earnings of carpenters are not as high as their hourly rates of pay indicate.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America. A small number are members of other unions. Union-employer contracts covering carpenters often provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers.

Like other building trades, the work of the carpenter is active and is sometimes strenuous, but exceptional physical strength is not required. Many young persons like carpentry because they are able to work out of doors. However, prolonged standing, as well as climbing and squatting, are often necessary. Carpenters risk injury from slips or falls, from contact with sharp or rough materials, and from the use of sharp tools and power equipment.

Where To Go for More Information

A young man wishing to obtain further information regarding carpentry apprenticeships or work opportunities in this trade should contact the carpentry contractors or general contractors in his area, a local of the carpenters' union (United Brotherhood of Carpenters and Joiners of America) or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment services screen applicants and give aptitude tests.

Further information on apprenticeship in this trade is also available from:

Associated General Contractors of America, Inc.,
1957 E St. NW., Washington 6, D.C.

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

United Brotherhood of Carpenters and Joiners of America,
222 East Michigan St., Indianapolis 4, Ind.

Painters and Paperhangers

(D.O.T. 5–27.010 through .920 and 5–28.100)

Nature of Work

Painters prepare the surfaces of buildings and other structures and then apply paint, varnish, enamel, lacquer, and similar materials to these surfaces. Paperhangers cover room interiors with paper, fabric, or other materials. Painting and paperhanging are distinct skilled building trades. However, many of these craftsmen do both types of work.

One of the important duties of the painter—especially in repainting—is to prepare the surface. Rough spots must be sandpapered, dust brushed off, grease removed, nail holes filled, and loose paint removed by scraping or by heating with a blowtorch and then scraping. Often, surfaces must be covered with a prime coat or sealer to provide a suitable surface or base on which to apply the new paint. Paint is applied to many kinds of materials, including wood, structural steel, and clay products, generally by means of a brush, spray gun, or roller.

A painter must be skilled in handling brushes and other painting tools, in order to apply paint thoroughly, uniformly, and rapidly to any type of surface. In addition, he must be able to mix paints, match colors, and have a knowledge of color harmony. He must also know the characteristics of common types of paints and finishes from the standpoints of durability, suitability for different purposes, and ease of handling and application. A painter must know how to erect the scaffolding from which he often works.

Painters use spray guns to paint surfaces or objects which are difficult to paint with a brush such as lattices, cinder and concrete block, and radiators. They also use spray guns on large areas which can be sprayed with a minimum of preparation. When using a roller (a rotating applicator covered with soft material) the painter rolls the applicator over the surface to be covered.

In paperhanging, the worker first applies "sizing" (a prepared material which prevents suction in the plaster and assures better sticking of the paper to the surface being covered). He then measures the area to be covered and cuts the paper to size. He mixes a paste and applies it to the reverse side of the paper. (When working with other wall coverings, such as those which are fabric-coated, the paperhanger applies an adhesive instead of a paste.) The paste-coated paper is then placed on the wall or ceiling in strips and smoothed into place with a dry brush. The paperhanger matches the adjacent edges of strips of figured paper, cuts overlapping ends, and smooths the seams between strips with a roller or other special tool. In redecorating work, it may be necessary to remove the old paper by soaking or, if there are many layers, by steaming. In many cases, it is also necessary for paperhangers to do minor plaster patching in order to get a smooth surface for the paper.

Where Employed

Most painters and paperhangers work for contractors engaged in new building construction work. Substantial numbers of painters and paperhangers are also employed by contractors to do repair, alteration, or modernization work. Hotels, office buildings, utility companies, manufacturing firms, schools and other government units, and other organizations that own extensive property, commonly employ maintenance painters. When interior redecorating involves papering also, as in hotels or apartment buildings, usually the maintenance painters may also do the paperhanging.

About 400,000 painters and 25,000 paperhangers were employed in mid-1958. The geographical distribution of employment in these occupations is similar to that in the building trades generally. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Most training authorities agree that completion of a 3-year formal apprenticeship is the best way to become a journeyman (skilled) painter or journeyman paperhanger. A substantial proportion of painters and paperhangers, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced craftsmen. Workers without formal apprentice training have gained acceptance as journeymen more easily in these crafts than in most of the other building trades.

Apprentice applicants are generally required to be between the ages of 16 and 21 and in good physical condition. A high school education is preferred although not essential. Applicants should have manual dexterity and a discerning color sense. They should not be allergic to paint fumes or to the various materials used in these trades. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship for painters and paperhangers generally consists of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. Many apprenticeships combine painting and paperhanging. The following is a general summary of a typical 3-year apprenticeship painter or paperhanger program: Learns to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; learns how to use sandpaper and putty and how to prime woodwork and prepare and "size" walls; learns how to remove wallpaper, calcimine, and paint; learns how to calcimine and whitewash, finish walls with flat-coat and enamel paint, finish wood trim with oil, enamel, and varnish; learns how to prepare stains, stain, fill pores, and shellac, paint outside, apply various types of wall covering, stipple with rag and sponge, blend and glaze walls and woodwork, make putty, and erect scaffolding.

In addition, the trainee receives related classroom instruction in color harmony, paint chemistry, estimating costs, making, mixing, and matching paints. He also learns the relationship between painting and paperhanging work and the work performed by the other building trades craftsmen.

Hourly wage rates for apprentices start at approximately 50 percent of the journeyman rate and increase periodically until the journeyman rate of pay is reached upon completion of apprenticeship. If apprentice applicants have had experience directly related to the trade, such as experience in the Armed Forces, the applicants may be granted advanced apprenticeship standing.

Painters and paperhangers may advance to the position of foreman. They may also advance to jobs as estimators for painting and decorating contractors, computing material requirements and labor costs. Some become superintendents on large contract painting jobs, or they may establish their own business as painting and decorating contractors. Success as a contractor, however, depends largely on having adequate financial resources and a sound knowledge of business principles and practices, and a thorough knowledge of the painting and paperhanging trades.

Employment Outlook

There will be thousands of opportunities for young men to learn these trades during the 1960's. Most of these opportunities will arise from the need to replace experienced workers who retire, die, or leave the trades for other reasons.

The employment of painters and paperhangers has increased at a much slower rate than most of the other building trades in recent years. It increased by about 25 percent in the period 1940–58, while employment in the skilled building trades as a whole about doubled. Despite the anticipated large expansion of construction activity during the 1960's (see discussion, p. 284) employment of painters will continue to grow slowly; employment of paperhangers is expected to increase somewhat or remain about the same.

Technological developments have affected and are expected to continue to affect both the number and skill requirements of painters. New types of paint which are more easily applied and have improved "covering power" have made it easier for inexperienced workers to do work which is acceptable to some consumers. Spray painting, which is used particularly on large, unbroken interior surfaces, requires fewer painters to do the same amount of work. Moreover, many items formerly painted at the building site now come from a factory or shop with a prime coat and often with a final coat. Aluminum building products which often require no painting have become increasingly common in recent years. These and other factors are expected to continue to slow the growth of employment of painters.

Employment prospects for paperhangers will continue to be limited by the substitution of paint for wallpaper as a covering for interior walls in residential and commercial buildings. The more widespread use of fabrics and other types of wall covering, however, may improve somewhat the employment outlook for these workers.

Because of the large size of the painter and paperhanger group, replacement needs are very great. Retirements and deaths alone will create about 10,000 job openings annually during the 1960's. Many other openings will result from the need to replace experienced workers who leave the trades for other reasons.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average union minimum hourly rate was $3.27 for painters and $3.24 for paperhangers. Among the individual cities, these rates ranged from $2 for painters in Charlotte, N.C., and $2.25 for paperhangers in Richmond, Va., and Louisville, to $3.60 for painters in Newark and $3.61 for paperhangers in Los Angeles. (See table 2, p. 287, for union minimum hourly wage rates for painters and paperhangers, in each of the 52 large cities.)

A large proportion of painters and paperhangers are members of the Brotherhood of Painters, Decorators and Paperhangers of America. A small number are members of other unions. Union-employer contracts covering these workers usually provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers.

Painters and paperhangers are often required to stand for long periods of time, to climb, and to bend at their work. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls from ladders and scaffolds. The number of injuries per million man-hours worked by employees of painting and paperhanging contractors in the contract construction industry is lower than that for contract construction as a whole, but higher than for all manufacturing industries.

Where To Go for More Information

A young man who wishes to obtain further information concerning painting and paperhanging apprenticeships or work opportunities in these trades should apply to a painting and decorator contractor in his area; a local of the Brotherhood of Painters, Decorators and Paperhangers of America; or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Brotherhood of Painters, Decorators and Paperhangers of America,
217–219 North Sixth St., Lafayette, Ind.

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

Painting and Decorating Contractors Association of America,
540 North Michigan Ave., Chicago 11, Ill.

Plumbers and Pipefitters

(D.O.T. 5–30.010, .026, .210, .410)

Nature of Work

Plumbers and pipefitters are highly skilled workers who install, alter, and repair pipe systems. They also install plumbing fixtures and appliances, and heating and refrigeration units.

Pipe systems provide steam, water or other liquids, air, or gas which are needed for sanitation, heat, power, waste disposal, fire protection, and other industrial uses. Plumbers and pipefitters install such systems in residential and commercial buildings; schools; power and chemical plants; sewage and water treatment plants; and other industrial establishments. Many operations requiring various skills are performed by plumbers and pipefitters when installing pipe systems. These include the bending of pipe and making welded, brazed, calked, soldered, or threaded joints. After a pipe system is installed, the plumber or pipefitter tests for leaks by filling pipes with water or air under pressure, and by using other methods.

Plumbers and pipefitters use handtools, such as wrenches, reamers, drills, braces and bits, hammers, chisels, and saws. They also use gas or gasoline torches and welding, soldering, and brazing equipment in their work. Power machines are often used to cut, bend, and thread pipes. Hand-operated hydraulic benders also are used to bend pipe.

This broad field of work is sometimes considered to be a single trade. However, plumbers and pipefitters may do somewhat different types of work, particularly in large cities. Plumbers mainly install water, gas, and waste disposal systems, particularly those which must be connected to public utility systems. Pipefitters install heating lines, such as hot water, and steam fitting systems, especially in industrial and commercial establishments. For example, they install pipes for ammonia systems in refrigeration plants, automatic sprinkler systems, lines for compressed air and industrial gages, and complex pipe systems in oil refineries, chemical plants, and food-processing plants.

Some plumbers and pipefitters specialize in gas fitting and steam fitting. Gas fitters install and maintain the gas fittings and the central gas main extensions which connect the main gas line to homes. Steam fitters assemble and install steam or hot water heating systems.

Where Employed

Most plumbers and pipefitters are employed by plumbing and pipefitting contractors in new building construction, mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers are employed by government agencies and public utilities, and some work for ship and aircraft companies. Others are employed as maintenance workers in industrial and commercial establishments. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries where the industrial operations include the processing of fluids through pipes.

Jobs for plumbers and pipefitters are found in almost every community in the country, but they are concentrated in the highly populated and industralized area. (See discussion, p. 281.) Most journeymen who specialize in steam and hot water heating systems are employed in large northern cities.

Training, Other Qualifications, and Advancement

Most training authorities recommend a 5-year apprenticeship program for plumbers and pipefitters as the best way to learn all the aspects of the trade. A substantial proportion of these craftsmen, however, have learned the trade informally. They have picked up the trade or one aspect of the trade by working for several years as helpers, observing or being taught by experienced craftsmen. Many of these persons have gained some of their knowledge of the trade by taking trade school or correspondence courses.

Apprentice applicants generally are required to be between the ages of 16 and 25 and in good physical condition. A high school education or its equivalent, including courses in mathematics, physics, and chemistry, is desirable. Applicants are often required to take aptitude tests, particularly to determine whether they have the high degree of mechanical aptitude required in this field.

Most apprenticeship training programs for plumbers and pipefitters are conducted under written agreements between the apprentices and local, joint union-employer apprenticeship committees, which also supervise the training. The apprenticeship committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards of training and, if necessary, schedules a rotating work program. This program is designed to give the apprentice diversified training by having him work for several plumbing or pipefitting contractors. Under formal apprenticeship programs, the apprentice is registered with the appropriate State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 10,000 hours (5 years) of on-the-job training, in addition to related classroom instruction. The following is a general summary of a typical 5-year combined plumber and pipefitter apprenticeship program: Learns how to use, care for, and handle safely the tools, machines, equipment and materials commonly used in the trade; learns how to install waste, vent, and water pipes, hot water, steam panel, and radiant-heating systems, and air-conditioning and powerplant piping systems; learns how to install plumbing fixtures, radiators, pumps, boilers, stokers, oil burners, gas furnaces, and the piping in septic tanks, cesspools, and sewers. The apprentice also learns welding and soldering, general repair work, and boiler replacement.

The apprentice also receives related classroom instruction in subjects such as drafting and blueprint reading; mathematics applicable to layout work; applied physics and chemistry; and local building laws and regulations which apply to the trade.

Hourly rates of apprentices in this trade start at about 50 percent of the journeyman rate and increase by about 5 percent in each 6-month period until a rate of 95 percent is reached during the last period of the apprenticeship. If apprentice applicants have had prior experience or training directly related to the trade they may, in some instances, be given advanced standing and pay. This experience or training may have been obtained in the Armed Forces or through courses in public or private schools.

In some localities, a journeyman's license is required for plumbers. To obtain this license, a person must pass a special examination to demonstrate his knowledge of the local building codes. The examination also tests his all-round knowledge of the trade.

Some journeymen plumbers and pipefitters may become foremen for a plumbing contractor. Many journeymen go into business for themselves. As they expand their activities, they may employ other workers and become plumbing and pipefitting contractors. In some localities, contractors are required to obtain a master plumber's (journeyman's) license. Basic requirements for success as a contractor are adequate financial resources and a sound knowledge of business principles and practices. A thorough knowledge of the pipe trade and an understanding of construction principles are also necessary.

Employment Outlook

A continued rapid rise in employment in this trade is expected during the 1960's. The rate of growth in this field will be much faster than the estimated 20-percent increase for the Nation's total working population. In addition to openings resulting from the increase in employment, many job opportunities for new workers will arise as a result of replacement needs.

Employment in this field has increased rapidly in recent years—from about 170,000 in 1940, to 278,000 in 1950, and to an estimated 315,000 in mid-1958. Several factors contribute to the expectation of a continued rapid rise in employment in this trade. Most important of these is the anticipated 40- to 50-percent increase in construction activity in the 1960's. (See discussion, p. 284.) Furthermore, plumbing and pipefitting has become increasingly important in many types of construction, particularly residential building. For example, there has been a trend toward more bathrooms per dwelling unit. Moreover, the more widespread installation of appliances such as washing machines and waste disposals requires more plumbing work. The increasing number of installations of automatic heating systems will also create more work for these craftsmen.

In addition, industrial pipe work is becoming more important in industry generally and requires more of these craftsmen for installation and maintenance work. For example, many industries, particularly the chemical and petroleum refining industries, which use extensive pipe work for their processing activities, are expected to expand their facilities substantially during the 1960's. Also, those industries which are automating their production activities will require more pipefitting work. The increasing industrial activities related to atomic energy and the greater use of refrigeration and air-conditioning equipment will also result in more work for plumbers and pipefitters. On the other hand, some technological developments, such as the growing use of factory prefabricated plumbing assemblies, may limit, somewhat, the growth in the number of jobs for plumbers and pipefitters.

In addition to job opportunities resulting from the growth in the trade, the need to replace experienced workers who retire, die, or leave the trade for some other reason will create thousands of job openings for new workers each year. Retirements and deaths alone will result in approximately 7,000 to 8,000 job openings annually during the 1960's.

Earnings and Working Conditions

Hourly wage rates for plumbers and pipefitters are among the highest in the skilled building trades and among skilled workers generally. Another important consideration for young persons considering plumbing and pipefitting as a career is that annual earnings of these workers are among the highest in the building trades because plumbing and pipefitting are affected less by seasonal factors than are most other building crafts.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate was $3.70 for plumbers and $3.71 for pipefitters compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates ranged from $3.10 for both plumbers and pipefitters in Charlotte, N.C., to $4.25 for plumbers in Newark and $4.30 for pipefitters in New York City. (See table 2, p. 287, for union minimum hourly wage rates for plumbers and pipefitters, in each of the 52 large cities.)

A large proportion of plumbers and pipefitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada. Some are members of other unions. Union-employer contracts covering plumbers and pipefitters often provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers.

The work of the plumber-pipefitter is active and sometimes strenuous, as is work in the other building trades. Frequently, the plumber-pipefitter stands for prolonged periods and occasionally he works in cramped or uncomfortable positions because much of his work is done in relatively inaccessible places. Since most of his work is indoors, he is less exposed to unfavorable weather conditions than are many other building tradesmen.

Workers in this trade risk the danger of falls from ladders, cuts from sharp tools, and burns from hot pipes or steam. The number of injuries per million man-hours worked by employees of plumbing, heating, and air-conditioning contractors in the contract construction industry is lower than that for contract construction as a whole, but higher than the average for production workers in manufacturing industries.

Where To Go for More Information

A young man who wishes to obtain further information concerning plumber or pipefitter apprenticeships or work opportunities in the trade should apply to a plumbing, heating, and air-conditioning contractor in his area, a local of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada, or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

Additional information may be obtained from:

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

National Association of Plumbing Contractors,
1016 20th St. NW., Washington 6, D.C.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada,
901 Massachusetts Ave. NW., Washington 1, D.C.

Bricklayers

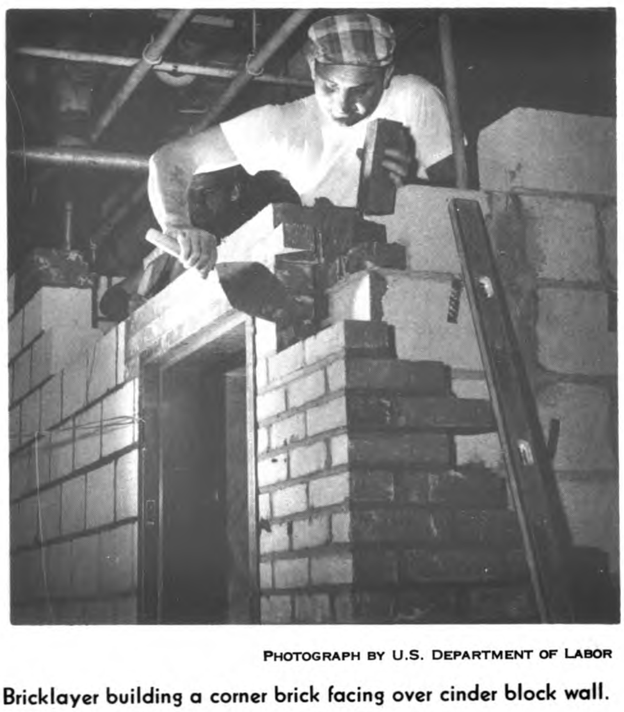
(D.O.T. 5–24.000 through .199)

Nature of Work

Bricklayers (sometimes called brickmasons) are skilled craftsmen who construct walls, partitions, fireplaces, chimneys, and other structures from brick or other masonry materials. They also install the brick lining of kilns and industrial furnaces. In addition to laying brick, they build structures with concrete block, cinder block, structural tile, terra cotta, and gypsum block.

In laying brick, a bricklayer first spreads a layer or "bed" of soft mortar. After applying mortar to one end of a brick, he places it on the bed of mortar and taps it with a trowel into the desired position. Then he cuts or scrapes off the excess mortar. When necessary, he breaks bricks with a trowel or brick hammer to fit spaces too small for whole bricks. As the work progresses, he checks the vertical and horizontal alinement of each course (row) with a gage line (tightly stretched cord) and mason's level. Using the point of a trowel or a special finishing tool, he finishes the mortar between the bricks to achieve a neat appearance. If two or more thicknesses of brick are being laid the brickmason lays a "bond" course at regular intervals, that is, he arranges a row of brick crosswise or in another "bond" pattern in order to tie the bricks together. When the bricklayer works with concrete block, structural tile, or other masonry material, the work is essentially the same.

Bricklaying requires careful, accurate work so that the brick structure will have a neat and uniform appearance and the rows of brick will line up with windows, doors, or other openings without excessive cutting of brick. The tools of the trade are almost all handtools, including chisels, trowels, jointers (a narrow tool used to shape mortar joints), bricklayer's hammers, gage lines, plumb bobs, and mason's levels. Power saws for cutting brick are also used. Journeymen (skilled) bricklayers are usually assisted by hod carriers or helpers who supply them with bricks



PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Bricklayer building a corner brick facing over cinder block wall.

and other materials, mix mortar, and set up and move scaffolding.

Where Employed

The great majority of bricklayers work mainly on new building construction. Some are employed in sewer construction work in which they construct manholes and catch basins. Repair and maintenance work is much less important for bricklayers than for other skilled building trades. However, bricklayers do a considerable amount of alteration work, especially in the larger cities where construction of fire-resistant partitions, store front remodeling, and similar modernization work, are often done.

Bricklayers also work for industrial establishments, such as factories making glass or steel, where furnaces and kilns require special fire brick and refractory brick linings. For example, in steel manufacturing, the bricklayer lines converters, cupolas, ladles, and tapping spouts. Bricklayers must have additional training to do refractory brick work.

Jobs for bricklayers are found throughout the country. Their employment, however, is concentrated in the more highly populated and industrialized areas. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Most training authorities agree that completion of a 3- or 4-year apprenticeship is the best way to learn this trade. However, a substantial proportion of bricklayers have learned the trade informally. They have picked up the trade by working for several years as helpers or hod carriers, observing or being taught by experienced bricklayers. Many of these persons have gained some knowledge of their trade by taking trade school courses.

Apprenticeship applicants are generally required to be between the ages of 17 and 24; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important assets. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program generally consists of from 6,000 to 8,000 hours (3 to 4 years) of on-the-job training, in addition to related classroom instruction. The following is a general summary of a typical 3-year bricklayer apprenticeship program: Learns how to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; learns how to lay brick (includes mixing and spreading mortar), bond and tie, build footings and foundations; learns how to do plain exterior brickwork such as straight wall work; learns how to build arches, columns, piers, and corners, plan and build chimneys, fireplaces, floors, lay stone, point brick and stone; learns how to clean stone, brick, and tile with water, acid, and by sandblasting; learns how to cut, set, and point cement blocks, artificial stone, glass blocks, and cork; learns how to fireproof. The apprentice also receives related classroom instruction in blueprint reading, layout work, and making measurements and sketches. In addition, he learns the relationship between bricklaying and other building trades.

A bricklayer has to have an eye for straight lines and proportions, and a knack for using his hands. Since the other building craftsmen must usually fit their work to his, he should know how the parts of a structure fit together. A fair degree of physical endurance is necessary.

Hourly wage rates for bricklayer apprentices start at 50 percent of the journeyman rate and increase periodically until 95 percent of the journeyman's rate is reached during the last period of the apprenticeship. If apprentice applicants have had training or experience directly related to the trade as, for example, in the Armed Forces or in a trade school, they may be given advanced standing.

In some areas, formal apprenticeship programs for bricklayers include brief, preliminary training at a vocational school or some other type of pre-job training which is designed to give the apprentice sufficient skill in the handling of tools and materials to make him productive at the start of his on-the-job training.

Bricklayers may advance to jobs as foremen. They may also become estimators for bricklaying contractors where their jobs consist of computing material requirements and labor costs. A small number advance to the position of bricklaying superintendent on large construction projects, while others start their own bricklaying contracting business. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of the trade, are basic requirements for success as a contractor.

Employment Outlook

Continued rapid increase in the employment of bricklayers is expected in the 1960's. Replacement needs will also provide many job opportunities for new workers.

Bricklaying has been one of the fastest growing building trades. Employment in this trade increased from about 105,000 in 1940 to 165,000 in 1950, and to about 250,000 in mid-1958. It is expected to grow faster than many of the other building trades and much faster than the estimated 20-percent increase for the Nation's total working population in the 1960's. Much of the growth will result from the anticipated sharp rise in new building construction activity. (See discussion, p. 284). Moreover, expected higher levels of personal income will increase the demand for higher priced homes; in general, the larger proportion of higher priced homes are made with brick. Also, increasing use of structural clay tile for fire-resistant partitions and glass blocks for exterior walls is expected.

Employment of bricklayers is expected to rise substantially despite a continuation of some technological construction developments which reduce the amount of brick used per structure. For example, the introduction of steel-frame and reinforced concrete structures has permitted the elimination of load-bearing exterior brick walls in buildings and the substitution of light metal panels. The use of large glass wall panels in many buildings is resulting in less masonry work. Also, ornamental brick work is being less widely used in building decoration.

In addition to job openings that will result from the expected growth of employment in this trade, the need to replace experienced bricklayers who retire, die, or leave the trade for other reasons will provide many job opportunities for new workers. Retirements and deaths alone will result in about 5,000 job openings annually during the 1960's.

Earnings and Working Conditions

Bricklayers generally receive the highest hourly wage rates among skilled building craftsmen. However, because the nature of their work is highly seasonal, more so than that of most of the other skilled building tradesmen, the average annual earnings of bricklayers are less than those for many other skilled building tradesmen.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for bricklayers was $3.87, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for bricklayers ranged from $3.10 in Charlotte, N.C., to $4.35 in New York. (See table 2, p. 286, for union minimum hourly wage rates for bricklayers in each of the 52 large cities.)

A large proportion of bricklayers are members of the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering bricklayers usually provide health insurance and pension benefits, financed either entirely by the employers or jointly by the workers and employers.

The work of the bricklayer is active and sometimes even strenuous, like the work in other building trades. It frequently involves stooping to pick up materials, moderately heavy lifting, and prolonged standing. Most of the work is done outdoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding bricklaying apprenticeships or work opportunities in the trade should apply to a bricklaying contractor in his area, a local of the Bricklayers, Masons and Plasterers International Union of America, or the local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide services such as screening applicants and giving aptitude tests.

Additional information may be obtained from:

Associated General Contractors of America, Inc.,
1957 E St. NW., Washington 6, D.C.

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D.C.

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

Structural Clay Products Institute,
1520 18th St. NW., Washington 6, D.C.

Operating Engineers (Construction Machinery Operators)

(D.O.T. 5–23.000 through .999 and 7–23.000 through .999)

Nature of Work

Operating engineers operate, maintain, and repair various types of power-driven construction machinery. Included among these machines are power shovels, cranes, dericks, hoists, pile drivers, concrete mixers, paving machines, trench excavators, bulldozers, tractors, and pumps. Some of these machines, such as earth-boring machines, are relatively simple to operate, but others, such as large cranes, are complex and require coordination of numerous controls. Thus, the range of skills is wider among operating engineers than among journeymen in any other building trade.

The broad range of skill requirements in this trade may be illustrated by describing the work performed by operating engineers in handling two types of machines—a crane and an earth-boring machine. The crane operator manipulates various pedals and levers to rotate the crane on its chassis and to raise and lower the crane boom and the loadline. The operator also manipulates a number of different attachments to the crane boom for various construction purposes. For example, he manipulates buckets for excavation work, pile drivers to drive steel beams, wood and concrete piling into the ground, and wrecking balls for demolition work. Good eye-hand-foot coordination, skill in precision handling of heavy equipment, and judgment in estimating proper load size are among the essential aptitudes for the crane operator's job. By contrast, the operation of earth-boring machines that dig holes for poles or posts is one of the less skilled tasks performed by operating engineers. The operator sets the proper auger (drill) in the spindle, starts the machine, and stops it when the auger has penetrated to the proper depth.

Operating engineers are often identified by titles describing the types of machines they operate—for example, craneman, bulldozer operator, or derrick operator. However, the more experienced operating engineers can generally handle a variety of construction machinery. These operators are employed on the more complex types of machines when jobs requiring such equipment are available, because higher wage rates are paid for the operation of such machines.

Where Employed

Most operating engineers are employed in construction work. They work for contractors engaged in highway, dam, airport, and other large-scale engineering projects. They are employed also on large building projects requiring extensive excavating, grading, and landscaping. Op-

Operating engineer operating a trenching machine.

erating engineers also work on small jobs, hoisting concrete, structural steel, and other materials. Others are employed by utility companies, manufacturers, and other business firms which do their own construction work, as well as by State and local public works and highway departments. Relatively few operating engineers are self-employed. Those who are self-employed are owner-operators of construction equipment, such as bulldozers and cranes.

In addition to employment in construction work, operating engineers operate cranes, hoists, and other power-driven machinery in factories and mines. In some cases, the duties of operating engineers in nonconstruction jobs are about the same as those in construction work. For example, operation of a crane to unload cars of coal at a factory is very similar to operation of a crane to unload cars of sand and gravel for a street paving job. On the other hand, the nature of the work of a steel pourer (craneman) in a steel mill differs considerably from that of a crane operator in the construction industry.

Operating engineers are employed in every section of the country, but mainly in the larger urban areas. This work, however, may take them to remote locations where highway construction and heavy engineering construction, such as dams, are being built. The geographical distribution of the estimated 190,000 operating engineers employed in mid-1958 was much the same as for the building trades generally. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Formal apprenticeship programs for operating engineers are available in some localities. For the most part, however, entrance into construction machinery operating jobs is informal. A young man with an aptitude for working with machinery and with some relevant experience such as truckdriving, may begin work as an oiler or a helper, or he may get a job operating one of the simpler machines, such as an air compressor. As openings occur he may be given a chance to operate somewhat more complicated machines, such as rollers. After some experience operating these machines, he is given the opportunity to operate the more complex machines. Often, informal instruction is given to new personnel by experienced operators. Large contractors frequently have a wide range of construction equipment, thus affording opportunities to learn the operation of successively more complex equipment.

Employment Outlook

A continued rapid rise in employment of construction machinery operators is expected during the 1960's primarily as a result of the anticipated large increase in construction activity. Particularly, the growing volume of highway construction resulting from the Federal Government's long-range multibillion dollar highway development program, will be especially important in providing thousands of job opportunities for operating engineers during the 1960's.

Moreover, the trend in the postwar period toward the increasing use of construction machinery shows every indication of continuing. Larger, more specialized, and more complex machines, particularly those used in earth-moving, as well as smaller machines suitable for small construction projects, are continually being developed and are expected to be used to a greater extent. The increasing mechanization of material movement in factories and mines should also result in growing employment of these workers outside of construction.

In addition to job openings resulting from the expected growth of employment in this occupation, the need to replace experienced construction machine operators who retire, die, or leave the trade for other reasons will create many job opportunities for new workers. Retirements and deaths alone will create about 4,000 to 5,000 job openings annually during the 1960's.

Earnings and Working Conditions

The wage rate structure for operating engineers is more complicated than for any other construction trade. Hourly rates are established not only for different types of machines, but often for machines of the same type but of different capacity. Moreover, in some cases there are different rates for the same machine, depending upon the type of construction for which it is used. The wage scale also varies among different parts of the country and the operators of machines having the top wage rates in one area do not necessarily receive the top wage rates in other areas.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades, as of July 1, 1958, in 52 large cities surveyed, showed the hourly scales for several classifications of construction machinery operators, including shovel operators and bulldozer operators. For shovel operators, who generally are among the highest paid construction machinery operators, the union minimum hourly rates ranged from \$2.80 in Oklahoma City to \$4.60 in Newark and New York; for bulldozer operators, the rates ranged from \$2.50 in Richmond to \$3.73 in New York City. (See table 2, p. 286, for union minimum hourly wage rates for shovel operators and bulldozer operators, in each of the 52 large cities.)

A large proportion of operating engineers are members of the International Union of Operating Engineers. Union-employer contracts covering these workers, in some areas, provide health insurance and pension benefits, financed either entirely by the employers or jointly by the workers and employers.

Much of the operating engineer's work is performed outdoors. The work is active and sometimes strenuous. The operation of some machines, particularly bulldozers and some types of scrapers, is physically wearing because the constant movement of the machine shakes or jolts the operator.

Where To Go for More Information

A young man who wishes to obtain further information regarding qualifications and training for the job of operating engineer, and the location of present apprenticeship programs, should contact the International Union of Operating Engineers, 1125 17th St. NW., Washington 6, D.C. Also, general contractors in the young man's local area should be contacted regarding work opportunities. The local office of the State employment service also is a source of information and a contact point for employment opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington 6, D.C.

Electricians (Construction)

(D.O.T. 4–97.010)

Nature of Work

Construction electricians perform the various tasks related to electrical work on construction projects. They lay out, assemble, install, and test electrical fixtures, apparatus, and wiring used in the heating, lighting, power, air-conditioning, refrigeration and other electrical systems of residences, office buildings, factories, hospitals, schools, and other structures. They also connect electrical machinery, equipment, and controls. Maintenance electricians do work which is similar in many respects to that performed by construction electricians. A discussion of maintenance electricians is presented elsewhere. (See index for page numbers.)

Following blueprints and specifications, or other instructions, construction electricians install many types of switches, conduits, controls, circuit breakers, wires, and other electrical components. If there is no electrical drawing showing which outlets are to be on each circuit, the electrician arranges them according to local codes and regulations so that the loads of electrical current will be properly adjusted and no circuit will have a heavier load than is permissible for the current-carrying capacity of the conductor used. The electrician should know and follow national electrical code regulations and in addition must fulfill State, county, and municipal regulations.

In installing wiring, the construction electrician uses a hydraulic bender to shape conduit (pipe or tubing) so that the conduit will fit the contours of the surface to which it is attached. The electrician then pulls insulated wires or cables through the conduit. The wire or cable sizes vary from those smaller than the lead in a pencil to those about 3 inches thick. The electrician then connects the ends of the wires or cables to circuit breakers, switchgears, or other components. When these operations are com-

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Construction electrician pulling wires through conduit.

pleted, the electrician tests the electrical circuits to determine whether the entire system is properly grounded and the connections are properly made, and whether any of the circuits are overloaded. Wires are spliced (joined) by soldering or other methods.

The electrician must furnish his own handtools, such as pliers, screwdrivers, brace and bits, knives, and hacksaws. The employer furnishes heavier tools, such as pipe threaders, conduit benders, chain hoists, electric drills, and power fasteners. In residential electrical construction work, the heavier tools are not usually required.

Electrical work in installations with unusually high electrical power requirements, such as are needed at powerplants, steel mills, and other establishments, may be done by journeymen (skilled) electricians who specialize in this type of work. However, most construction electricians are capable of doing all types of electrical work.

Where Employed

Most construction electricians work for electrical contractors. However, substantial numbers are self-employed. Others work for government agencies or business establishments which do their own construction electrical work rather than hire electrical contractors. Although many construction electricians work for the same electrical contractor for several years, job transfers are fairly common so that during a single year a construction electrician may work for an electrical contractor in the construction of new homes or office buildings, for a manufacturing firm in remodeling its plant or offices, or he may do electrical repairs for homeowners or business firms.

Employment of these workers is distributed geographically in much the same pattern as the Nation's population. Thus, employment is concentrated in the highly industrialized and populated areas. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Completion of a 4- or 5-year apprenticeship program for construction electricians is recommended by training authorities as the best way to learn all the aspects of this trade. Some construction electricians, however, have learned the trade informally. They have picked up the trade or one aspect of the trade by working for several years as helpers, observing or being taught by experienced craftsmen. Many of these persons have gained some knowledge of the trade by taking trade school or correspondence courses.

Apprenticeship applicants generally are required to be between the ages of 18 and 24. A high school education or its equivalent, including courses in mathematics and physics, is desirable. Applicants are required to take tests to determine their aptitude for the trade.

All apprenticeship programs are conducted under written agreements between the apprentice and local, joint union-employer apprenticeship committees which also supervise the training. The local, joint apprenticeship committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards and pay, and schedules a diversified, rotating work program. This program is designed to give the apprentice all-round training by having him work for several electrical contractors who engage in particular types of work. Under most programs, the apprentice is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The International Brotherhood of Electrical Workers and the National Electrical Contractors Association have jointly developed an extensive apprenticeship program. They have a national director of apprenticeship who assists the local unions and chapters in this industry through the local, joint apprenticeship committee.

The apprenticeship program usually requires 8,000 or 10,000 hours (4 or 5 years) of on-the-job training, in addition to a minimum of 144 hours each year of related classroom instruction. The following is a general summary of a typical 4-year apprenticeship program for construction electricians: Learns how to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; learns how to do residential, commercial and industrial installations; learns how to maintain and repair installations. In addition, he receives related classroom instruction in subjects, such as drafting and electrical layout, mathematics, and electrical theory.

Hourly wage rates of apprentices often start at about 50 percent of the journeyman rate and increase by 5 percent in each 6-month period until 85 or 90 percent of the journeyman rate is reached during the last period of the apprenticeship.

An experienced construction electrician who has learned all the aspects of the craft through apprenticeship can transfer readily to other types of electrical work. For example, many take jobs as maintenance electricians in factories or in commercial establishments and others work as electricians in shipbuilding and aircraft manufacturing.

Because improperly installed electrical work is so hazardous, many localities require electricians to be licensed. To obtain a license, the electrician must pass an examination which requires a thorough knowledge of the craft, and of State and local building codes.

Many journeymen electricians become foremen or superintendents for electrical contractors on particular construction jobs. These craftsmen may also become estimators for electrical contractors, computing material requirements and labor costs.

Many journeymen construction electricians go into business for themselves. As they expand their activities, they may employ other workers and become contractors. Success as an electrical contractor, however, requires adequate financial resources and a sound knowledge of business principles and practices. In most large urban areas, a master (journeyman) electrician's license is required in order to engage in an electrical contracting business.

Employment Outlook

A substantial increase in the number of construction electricians is expected in the 1960's. Employment in this trade is expected to rise more rapidly than in most of the other skilled building trades. In addition to job openings arising from the growth of the trade, many other job opportunities for new workers will be created by the need to replace experienced electricians who retire, die, transfer to other types of electrical work, or leave the field for other reasons. This is a large occupation—about 130,000 construction electricians were employed in mid-1958—and retirements and deaths alone will result in about 3,000 to 3,500 job openings annually during the 1960's.

Employment of construction electricians more than doubled between 1940 and 1958. Continued growth in this occupation is expected as a result of the anticipated large expansion in construction activity during the 1960's. (See discussion, p. 284.) Moreover, the increasing use of electrical appliances and devices in homes, factories, and commercial buildings has resulted in the doubling of electric power production every 10 years since 1900 and this trend is expected to continue in the next decade. As a result, work opportunities for construction electricians are expected to increase.

Earnings and Working Conditions

Hourly wage rates of construction electricians are among the highest in the skilled building trades. Furthermore, because the seasonal nature of construction work affects electricians to a lesser extent than most other construction workers, their annual earnings generally are among the highest in the building trades.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for electricians was \$3.68, compared with \$3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for construction electricians ranged from \$2.90 in Charlotte, N.C., to \$4.35 in Pittsburgh. (See table 2, p. 286, for union minimum hourly wage rates for construction electricians, in each of the 52 large cities.)

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers. Some are members of other unions. Union-employer contracts covering construction electricians usually provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers. The union also operates its own pension program.

The work of the construction electrician, like that of other building trades, is active but does not require great physical strength. Frequently, the construction electrician stands for prolonged periods; sometimes he works in cramped quarters. Because most of his work is indoors, the construction electrician is less exposed to unfavorable weather conditions than most other skilled building trades workers. Electricians risk the danger of falls from ladders, cuts from sharp tools, electrical shock, and burns from "live" wires. However, safety practices learned during apprenticeship and other types of training have helped to reduce the injury rate for these workers. The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of work injuries shows that in 1957, the injury-frequency rate for employees in contract electrical work was less than that for contract construction work as a whole, but higher than that for production workers in manufacturing industries.

Where To Go for More Information

A young man who wishes to obtain further information regarding electrician apprenticeships or work opportunities in the trade should apply to one of the electrical contractors in his area, or to a local of the International Brotherhood of Electrical Workers, or to a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

Additional information may be obtained from:

International Brotherhood of Electrical Workers,
1200 15th St. NW., Washington 5, D.C.

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

National Electrical Contractors Association,
1220 18th St. NW., Washington 6, D.C.

National Joint Apprenticeship and Training Committee for the Electrical Industry,
1200 18th St. NW., Washington 6, D.C.

For information on the employment outlook for the various electrical fields, see:

Employment Outlook in Skilled Electrical and Electronic Occupations, VA Pamphlet 7–9. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price 40 cents.

Structural-, Ornamental-, and Reinforcing-Iron (Rodmen) Workers

(D.O.T. 4–84.010, .020, .030, .040, .060, 7–32.251)

Nature of Work

Structural- and ornamental-iron workers and reinforcing-iron workers (rodmen) erect, assemble, or install fabricated structural metal products in the construction of industrial, commercial, and large residential buildings. Although these are distinct trades, many craftsmen are skilled in, and do the work of, two or all three of the trades.

Structural-iron workers erect the steel framework of bridges, buildings, and other structures including metal storage tanks, and overhead crane runways that support heavy equipment. They install steel floor decking and vault doors and their frames.

In erecting a steel framework or structure, structural-iron workers take the steel shapes already fabricated in shops by other workers and hoist them into place in the proper order. Next, they temporarily connect all the steel shapes with bolts, accurately aline the structure, and rivet or weld the parts. In the construction of a large building, workers generally do not perform all of these operations. Instead, separate gangs perform a particular operation, such as riveting.

Structural-iron workers erecting structural steel framework.

Ornamental-iron workers install metal stairways, catwalks, floor gratings, and iron ladders, such as those used extensively in powerhouse and chemical plants, as well as metal window sash and doors, grilles, and screens (like those used in bank tellers' compartments and elevators), metal cabinets, and safety deposit boxes. They also install decorative ironwork on balconies, lampposts, gates, and fences.

In addition to iron and steel, ornamental-iron workers work with aluminum alloy, brass, and bronze metal shapes. The metal shapes which they install have been fabricated in a factory or a shop. They fasten these metal products permanently to a building or other structure by bolting, setting in concrete, or welding.

Reinforcing-iron workers (*rodmen*) set steel bars in concrete forms to reinforce the concrete structures. They place the steel bars on suitable supports in the concrete form and tie the bars together at intersections, so that each bar receives its intended structural load. The bars are placed in the concrete form according to blueprints, specifications, or verbal instructions. The rodmen use steel pliers and other tying tools to wire the rods securely in place. Some concrete reinforcing is in the form of coarse mesh made of heavy steel wires. When using mesh, the rodmen measure the surface to be covered, cut and bend the mesh to the desired shape, place the mesh over the area to be reinforced, and hammer it into place.

Where Employed

Structural-, ornamental-, and reinforcing-iron workers (rodmen) are employed primarily on new industrial and commercial construction. They also do some alteration work. For example, they may install steel stairs in an old apartment or commercial building or they may add window guards to an existing building for burglary protection. These workers also do a small amount of repair work, such as replacement of a metal bridge part. Some highly skilled structural steel workers are able to transfer to jobs in structural steel fabricating shops.

A large proportion of these craftsmen are employed by general contractors, on large building projects, or by steel erection contractors or ornamental-iron contractors. Many are employed by large steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial establishments which do their own construction work. Few of these craftsmen are self-employed.

Structural- and ornamental-iron workers and rodmen are employed throughout the country. However, a large proportion of their jobs are in the highly populated and industrial centers where large commercial and industrial structures are constructed. (See discussion, p. 281.)

Training and Other Qualifications

Completion of a 2-year apprenticeship is recommended by training authorities generally as the best way to learn these trades. A few workers with several years' experience as helpers have become journeymen, but it has been more difficult to achieve journeyman status in this manner in recent years.

Apprenticeship applicants are required to be between the ages of 17 and 30. Good physical condition is required. A high school education or its equivalent is desirable. Apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Under formal programs, the apprentice is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program for these trades usually consists of 4,000 hours (2 years) of on-the-job training, in addition to related classroom instruction.

On-the-job instruction is given either by the foreman or an experienced journeyman. The following is a general summary of a typical combined structural- and ornamental-iron worker's apprenticeship program: Learns how to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; learns how to read blueprints and working drawings; learns how to form, shape, drill, tap, and erect and assemble various metal structures; learns how to lay out and assemble steel stairs, fire escapes, grilles, railings, fences, doors, and related metal structures; learns arc and gas welding; gas cutting, bolting, and riveting; and how to repair and alter metal structures.

In addition, the apprenticeship program generally includes a minimum of 144 hours a year of related classroom instruction in subjects, such as drafting, blueprint reading, and mathematics applicable to layout work. Areawide apprenticeship programs, sometimes covering an entire State or region, are found extensively in this trade. They are supervised by apprenticeship committees composed of representatives of the International Association of Bridge, Structural and Ornamental Iron Workers' local union and the local employer group.

Hourly wage rates for apprentices start at not less than 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of the apprenticeship. In some localities, the starting rate may be as high as 75 percent of the journeyman rate. If apprenticeship applicants have had experience directly related to the trade as, for example, training in ironwork in a factory or in the Armed Forces, they may be granted advanced apprenticeship standing.

Employment Outlook

A substantial increase in the estimated 90,000 workers employed in these trades in mid-1958 is expected during the 1960's. In addition to job openings resulting from the growth of employment in these occupations, the need to replace experienced workers who retire, die, or leave the trade for other reasons will create several thousand job opportunities for new workers each year. Retirements and deaths alone will create about 2,000 job openings annually during the 1960's.

In recent years, these trades have been among the fastest growing of the skilled building trades. Employment of structural- and ornamental-iron workers and rodmen about tripled between 1940 and 1958. A continued rapid rise in employment of these workers is expected during the 1960's, principally because of the anticipated large expansion in construction activity. (See discussion, p. 284.) The job outlook in these trades will also be favorably affected by the increased use of structural steel in smaller buildings.

In addition, work opportunities for ornamental-iron workers will be created by the growing use of ornamental panels of aluminum, porcelainized steel, stainless steel, or other metals which are attached to the exterior walls of large buildings, and by the use of frames (mullions) to hold large exterior glass installations.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate was $3.62 for structural-iron workers and $3.51 for rodmen, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates ranged from $3 in Charlotte, N.C., to $4.55 in Newark for structural-iron workers, and from $2.75 in Charlotte, N.C., to $4.55 in Newark for rodmen. The rates for ornamental-iron workers generally are the same as those for structural-iron workers. (See table 2, p. 287, for union minimum hourly wage rates for structural-iron workers and rodmen, in each of the 52 large cities.)

The earnings of ironworkers are often augmented by considerable overtime work at premium pay. As with other building trades in which much of the work is done outdoors, these craftsmen lose much working time because of weather and other reasons. Rodmen, in particular, are intermittently out of work because each of their jobs lasts only a few days or weeks.

A large proportion of workers in these trades are members of the International Association of Bridge, Structural and Ornamental Iron Workers. Many union-employer contracts covering these trades provide health insurance and pension benefits financed entirely by the employers.

Since the materials used in the structural metal trades are heavy and bulky, above average physical strength and agility are necessary. A good sense of balance is also required because some of the structural work is done at great heights and on narrow footings. Structural-iron work often involves considerable travel. In most localities, the demand for structural-iron work is insufficient to keep a large structural-steel contractor or local crews constantly employed. Consequently, workers must be brought in from outside the area to handle the occasional large construction projects, such as a steel frame office or factory building. Large contractors may keep a nucleus of their structural-iron worker crew continually employed, moving them from job to job and city to city.

The use of many safety devices, such as nets and scaffolding, has reduced the frequency of accidents in recent years. However, the injury rate in contract structural- and ornamental-iron work is somewhat higher than for contract construction work as a whole.

Where To Go for More Information

A young man who wishes to obtain further information concerning apprenticeships or work opportunities in these trades should apply to the large general contractors in his area or to a local of the International Association of Bridge, Structural and Ornamental Iron Workers. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington 6, D.C.

International Association of Bridge, Structural and Ornamental Iron Workers,
Continental Bldg., Suite 300, 3615 Olive St., St. Louis 8, Mo.

Plasterers

(D.O.T. 5–29.100, .200, and .300)

Nature of Work

Plasterers apply gypsum plaster to walls and ceilings in the interior of buildings to produce finished surfaces. They also apply "stucco" on the exterior of buildings. The skilled plasterer, following blueprint instructions, may also make the intricate ornamental designs furnished by the architect, such as cornices and paneling. In addition, the plasterer applies gypsum materials used in the fireproofing of structural steel or in insulating exterior walls.

In interior work, the plasterer uses a trowel to spread gypsum plaster (a mixture of chalk, fiber, sand, or other ingredients) on walls and ceilings of masonry, rock lath, or metal lath. Two separate base coats of the plaster usually are applied, to a total thickness ranging from one-half to three-quarters of an inch, with a setting period between the coats. The second coat is brought to an accurate and level surface with a straightedge (a long flat board). After the second coat has dried sufficiently, the plasterer applies a finish coat, which may consist of a mixture of lime and gypsum plaster. The finish coat is usually applied to a thickness of one-eighth of an inch and may be troweled to a smooth surface or finished in a variety of textures.

In exterior stucco work, the plasterer applies a mixture of portland cement and sand to masonry or metal lath, in the same manner as in interior plastering. The finish coat usually consists of a mixture of white cement and sand or

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Plasterer applying white plaster finish to wall using plasterers' trowel and brush.

a patented finish material which may be applied in a variety of colors and textures.

Apprentices assist the plasterer wherever possible, so that they may acquire a full knowledge of the craft and develop the necessary skills. Laborers (hod carriers) mix base coat materials and carry them to the plasterer; they also erect scaffolding when needed. In many small localities, journeymen plasterers also perform the work of cement finishers.

Plaster-mixing machines are largely replacing hand-mixing techniques. When working with the recently developed lightweight plasters, plasterers are making increasing use of plaster machines to spray the plaster on walls and ceilings. In particular, these lightweight plasters have been used for fireproofing structural steel in large buildings.

Where Employed

Most of the approximately 68,000 plasterers employed in mid-1958 were working on new building construction. In addition, plasterers work on extensive building alterations, particularly where special architectural and lighting effects are part of the building modernization. There is a relatively small amount of work for plasterers in the repair and maintenance of older buildings.

Jobs for plasterers are found throughout the country. The geographical distribution of employment in this occupation is about the same as in the building trades generally. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Most training authorities recommend a 3- or 4-year apprenticeship as the best way to learn the plastering trade. A substantial proportion of plasterers, however, have learned the skills of this occupation informally. They have picked up the trade by working for several years as helpers or laborers, observing or being taught by experienced plasterers.

Apprentice applicants in this trade are generally required to be between the ages of 18 and 25. Good physical condition and manual dexterity are important assets. Many plasterer apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training. The programs generally consist of 6,000 to 8,000 hours (3 to 4 years) of on-the-job training, in addition to related classroom instruction. During the apprenticeship period, the apprentice learns how to use and handle the tools of the trade. He learns the properties and appropriate handling of the different kinds of materials and mixtures used in plastering. He is taught to lay out curved, arched, vaulted, and other ornamental work, which may present difficult geometrical problems. The apprentice also becomes familiar with the work of other trades so that he may determine, for example, whether lathing or other preparatory work is satisfactory. Generally, the apprenticeship program also includes at least 144 hours of related classroom instruction each year in subjects such as drafting, blueprint reading, and mathematics applicable to layout work.

The following is a general summary of a typical 4-year plasterer apprenticeship work program: Learns how to use plastering tools and materials; learns how to apply scratch (first) coat and brown (second) coat; learns how to line, dot, and brown coat; learns how to line, dot, and screed; learns how to apply whitecoat and sand finish; learns how to install acoustical plaster and stucco; learns texture finishing and installation of acoustical tile, cork, and similar materials; learns how to use browning and finishing machines; learns how to prepare molds, templates, and cornices and how to lay out groins, arches, and coffered ceilings.

Most plasterers remain journeymen throughout their working life, but some may advance to jobs as foremen or estimators. Many plasterers are self-employed. Some self-employed plasterers are able to expand their activities to contracting, and then hire other journeymen. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of the trade, are basic requirements for success as a contractor.

Employment Outlook

A continued increase in the employment of plasterers is expected during the 1960's, at about the same rate as for the skilled building trades generally. In addition to job openings that will result from the expected growth of employment, the need to replace experienced plasterers who retire, die, or transfer to other fields of work will provide many job openings for new workers. Retirements and deaths alone will result in about 1,500 job openings annually during the 1960's.

The growth in employment of these workers in the 1960's will result primarily from the anticipated large increase in construction activity. (See discussion, p. 284.) In addition, recent changes in plastering materials and improved methods of applying these materials are increasing the scope of the craft and creating work opportunities for plasterers. For example, improved lightweight plasters are being used increasingly because of their excellent soundproofing, acoustical, and fireproofing qualities. Another development that is expanding job opportunities for plasterers is the marked style trend toward the greater use of curved surfaces and ceilings made of plaster, both as a form of architectural treatment and to achieve special lighting effects.

These favorable developments will be offset to some extent by the continuing trend toward the greater use of nonplaster (drywall) construction, and the much less extensive use of ornamental plastering in large office buildings, banks, churches, theaters, and hotels.

Earnings and Working Conditions

Hourly pay rates for plasterers rank among the highest in the skilled building trades. However, their annual earnings are lower than the average for the skilled building trades as a group. In slack periods, plasterers generally cannot add to their earnings by doing maintenance and repair work, as much as can other building craftsmen.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for plasterers was $3.75, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for plasterers ranged from $2.63 in Charlotte, N.C., to $4.35 in New York. (See table 2, p. 287, for union minimum hourly wage rates for plasterers, in each of the 52 large cities.)

A large proportion of plasterers are members of unions. They are represented either by the Bricklayers, Masons and Plasterers International Union of America or the Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada. Union-employer contracts covering plasterers usually provide health and life insurance and pension benefits, financed either entirely by employers or jointly by workers and employers.

Plastering requires considerable standing, stooping, and lifting. Most plastering work is done indoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding plastering apprenticeships or work opportunities in the trade should apply to a plastering contractor in his area; locals of the plasterers' unions (Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada, or the Bricklayers, Masons and Plasterers International Union of America); or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D.C.

Contracting Plasterers' and Lathers' International Association,
711 14th St. NW., Washington 5, D.C.

National Bureau for Lathing and Plastering,
311 Tower Bldg., 1401 K St. NW., Washington 5, D.C.

Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada,
335 Euclid Ave., Cleveland 14, Ohio.

Roofers

(D.O.T. 5-25.220, 7-31.100 through .500, and 7-32.611)

Nature of Work

Roofers apply composition roofing and other materials, such as tile and slate, to the roofs of buildings. They also waterproof and dampproof walls and other building surfaces.

In applying composition roofing, the roofer first places overlapping strips of asphalt and impregnated felt over the entire surface. He then applies a coating of tar, pitch, or other bituminous material to the new surface. This process is repeated until at least three layers or thickness of felt are in place. Finally, he applies a surfacing of tar, pitch, and gravel to protect the roofing materials from the weather.

The composition roofer also lays other types of commercial composition roofing, such as roll roofing and asphalt shingles. In applying these materials, the roofer overlaps the roofing material and then fastens it to the roof base with nails or asphalt cement. If necessary, he cuts the material to fit corners, pipes, and chimneys. The roofer then cements or nails flashing (strips of metal) wherever two roof surfaces intersect. Flashing is installed to make the intersections (joints) watertight. In another method of applying roofing, the roofer mops a layer of hot asphalt over the entire surface and rakes pebbles over the asphalt.

Roofers also use metal, tile, and slate for the more expensive types of roofs. Metal roofs are constructed by soldering metal sheets together and nailing them to the wood sheathing. In installing tile and slate roofs, the roofer places a covering of roofing felt over the roofing sheathing. He punches holes in the slate or tile which he nails to the wood sheathing. Each piece of slate or tile is placed so as to overlap the adjoining piece and is nailed into place. Finally, the roofer covers the exposed nailheads with roofing cement to protect them from the weather. Usually, handtools are used in applying roof surfaces—for example, hammers, roofing knives, mops, pincers, and calking guns.

Roofers also do waterproofing and dampproofing work on parts of structures other than roofs, such as masonry or concrete walls that are in contact with the ground, swimming pools, and other tanks. The roofer prepares surfaces to be waterproofed by removing rough projections and roughing glazed surfaces, using a hammer and chisel. He then applies a coat of liquid compound with a brush. He may also paint or spray surfaces with a waterproof material or nail waterproofing fabric to surfaces. In dampproofing work, he usually sprays a coating of tar or asphalt on interior or exterior surfaces to prevent the penetration of moisture.

Where Employed

Roofers work mainly for roofing contractors on new building construction. They also do maintenance and repair work, especially on composition roofing. Some roofers are self-employed doing either roofing on small, new building work or repairs and alterations. Roofers also work for government agencies or business establishments which do their own construction and repair work.

The jobs of the approximately 58,000 roofers employed in mid-1958 were found in every State, with concentrations in the highly industrialized and populated States. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Completion of a 3-year apprenticeship program covering all types of roofing work generally is recommended by authorities in this field as the superior way to learn this trade. A substantial proportion of roofers, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced roofers.

Apprenticeship applicants generally are required to be at least 18 years old; a high school education or its equivalent is desirable. Good physical condition and a good sense of balance are important assets. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program generally consists of a minimum of 525 days (3 years) of on-the-job training, in addition to related classroom instruction. The following is a general summary of a typical 3-year apprenticeship work program for roofers: Learns how to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; learns how to work with composition, tar, and asphalt, and how to prepare roof surfaces for covering; learns how to apply pitch and other materials to roof and how to spread gravel; learns how to do slate, tile, and terra cotta work; and learns how to do dampproofing and waterproofing work.

During the apprenticeship period, the trainee also receives related classroom instruction in such subjects as blueprint reading and mathematics applicable to layout work.

Hourly wage rates for apprentices start at about 65 percent of the journeyman rate and increase periodically until 90 percent of the journeyman rate is reached in the final 6 months of the training period. If apprentice applicants have had experience directly related to the trade, for example in the Armed Forces, or as a helper, they may be granted advanced apprenticeship standing.

Roofers may advance to the position of foreman for a roofing contractor. Also, they may enter business for themselves. However, adequate financial resources and a sound knowledge of business principles and practices are basic requirements for success as a roofing contractor.

Employment Outlook

There will be a few thousand new job opportunities in this occupation annually during the 1960's. Many of the openings will result from the anticipated large expansion in construction activity. (See discussion, p. 284.) The need to replace workers who retire, die, or transfer to other fields of work will also create many job openings. Retirements and deaths alone will result in about 1,200 job opportunities annually during the 1960's.

Application of roofing on new construction and repair will provide most of the work for these building craftsmen. However, dampproofing and waterproofing are providing an increasing proportion of the roofers' work.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate was $3.26 for composition roofers and $3.37 for slate and tile roofers. Among the individual cities, the union minimum hourly wage rate ranged from $2.15 in San Antonio to $4.05 in Newark for composition roofers, and from $2.43 in Knoxville to $4.45 in New York for slate and tile roofers. (See table 2, p. 287, for union minimum hourly wage rates for roofers in each of the 52 large cities.)

A large proportion of roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association.

Union-employer contracts covering roofers usually provide health insurance and pension benefits, financed either entirely by the employers or jointly by the workers and employers.

Roofers' work, like that of other building tradesmen, is sometimes strenuous. It involves prolonged standing, as well as climbing, bending, and squatting. These workers risk injuries from slips or falls from scaffolds or roofs. They may have to work outdoors in all types of weather, particularly when doing repair work.

Where To Go for More Information

A young man who wishes to obtain further information concerning roofing apprenticeships or work opportunities in this trade should apply to roofing contractors in his area; a local of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

National Association of Home Builders,
1625 L St. NW., Washington 6, D.C.

National Roofing Contractors Association,
315 West Madison St., Chicago 6, Ill.

United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association,
6 East Lake St., Chicago 1, Ill.

Cement Finishers (Cement or Concrete Masons)

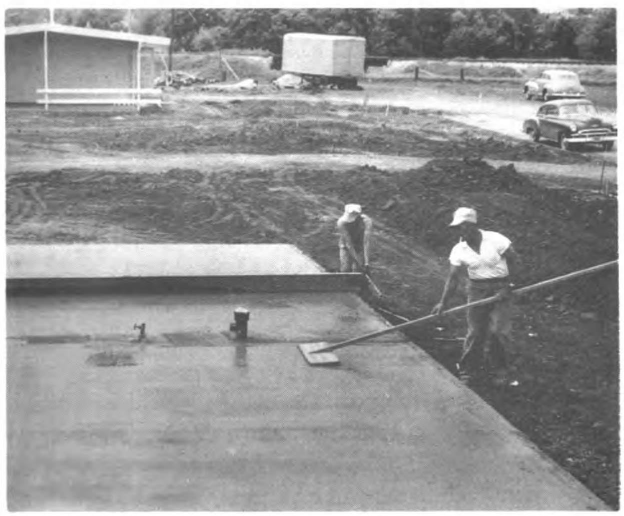
(D.O.T. 5–26.100 and .200)

Nature of Work

The principal work of cement finishers (also known as cement masons or concrete masons) is finishing the exposed concrete surfaces of floors, walls, streets, and driveways, in order to make them strong and durable and, where necessary, relatively watertight. On small jobs, the cement mason pours or directs the pouring of concrete into forms or on carefully prepared bases. He then levels and settles the concrete, usually by tamping it or by vibrating it with a special machine. The surface of the concrete is then worked with a straightedge (a long flat board), a wood float (a tool shaped like a mortar board), and other handtools in order to bring it to the desired grade (level). The cement finisher also slopes and shapes the concrete, and removes all depressions and high spots. Final finishing is often delayed for several hours until the concrete has hardened sufficiently to prevent small stones from working their way up to the surface. At this stage, when the concrete is still workable, the cement mason works it with a trowel to bring the concrete to the proper consistency and obtain a final finish. The final finishing may also be done by means of hand grinders or electrically operated grinders.

On most concrete building projects, finishing work generally involves hand operations. On highways and other large-scale projects, however, cement finishing machines are used extensively, but supplementary hand operations are also necessary, particularly to finish curved surfaces.

Cement masons also do patching work to correct surface defects on concrete structures. Some cement masons specialize in laying a mastic base over concrete, praticularly in buildings where sound-insulated or acid-resistant floors are specified. The mastic (a fine asphalt mixture) is ap-



Cement finisher smoothing house slab after helpers have leveled it.

plied hot over the concrete and then smoothed with heavy handtools.

On large jobs, cement finishers work in gangs or crews. Helpers assist the cement finishers in performing all but the final finishing operations and laborers do the routine and heavy work.

Where Employed

Cement masons work principally on large buildings although many are employed on highway or other nonbuilding construction. Cement masons work directly for general contractors who have contracts to construct entire projects such as highways, or large industrial, commercial, and residential buildings. They also work for cement contractors who perform subcontracting or who work on smaller projects such as sidewalks, driveways, and basement floors. A small number work for municipal public works departments, utilities, and manufacturing firms which do their own construction work. Some cement masons are self-employed and do small cement jobs, such as sidewalks, steps, and driveways.

Cement masons are employed in almost every community in the country. The geographical distribution of employment in this occupation is about the same as in the building trades generally. (See discussion, p. 281.)

Training and Other Qualifications

Completion of a 3-year apprenticeship program for cement finishers is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of cement masons, however, have learned the trade informally. They have picked up the trade by working for several years as helpers, observing or being taught by experienced cement masons.

Apprenticeship applicants generally are required to be between the ages of 18 and 25. Good physical condition and manual dexterity are important assets. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship registration agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. During the apprenticeship period, the apprentice learns how to use and handle the tools, equipment, and materials of the trade. He learns finishing, layout work, and safety techniques. He also receives related classroom instruction in subjects such as applied mathematics and related sciences, blueprint reading, architectural drawing, estimating materials and costs, and local building regulations. Although a high school education is not required, education above the grade school level, preferably including mathematics, is needed to understand the classroom instruction.

Employment Outlook

A continued rapid increase in the employment of these workers is expected during the 1960's. This occupation is expected to grow at a faster rate than the skilled building trades as a whole. In addition to openings resulting from the growth of the trade, replacement needs will create hundreds of other job opportunities for new workers each year.

The employment of cement masons has shown one of the fastest rates of growth among building trades craftsmen in recent years. The number of cement masons increased from about 15,000 in 1940, to 30,000 in 1950, and to about 45,000 in mid-1958. The anticipated large expansion of construction activity is expected to result in continued rapid growth in this occupation in the 1960's. (See discussion, p. 284.) Moreover, the relatively greater use of concrete construction in recent years is likely to continue. Recent technological developments, such as cement finishing machines, will have some adverse effect on employment prospects in the cement finishing trade. However, the expected increase in the total amount of cement finishing work will be sufficiently great to result in a substantial employment increase in this relatively small building trade.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for cement finishers was $3.43. Among the individual cities, the union minimum hourly wage rates for cement finishers ranged from $2.38 in Charlotte, N.C., to $4.30 in Newark. (See table 2, p. 286, for union minimum hourly wage rates for cement finishers, in each of the 52 large cities.)

Because of the seasonal nature of construction work and because of time lost for other reasons, the average annual earnings of cement finishers are not as high as their hourly rates of pay would indicate. Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. The need for overtime work for these craftsmen often arises, because once concrete has been poured for a job, the work must be completed.

The work of the cement mason is active and strenuous, like the work of the skilled building tradesmen generally. Since most cement finishing is done on floors or at ground level, the cement mason is required to stoop, bend, and kneel. Much of his work is done outdoors.

A large proportion of cement masons are union members. They belong to either the Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada or the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering cement finishers often provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers.

Where To Go for More Information

A young man who wishes to obtain further information regarding cement finishing apprenticeships or work opportunities in the trade should apply to a cement finishing contractor in his area; locals of the Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada or the Bricklayers, Masons and Plasterers International Union of America; or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may beobtained from:

Associated General Contractors of America, Inc.,
1957 E St. NW., Washington 6, D.C.

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D.C.

Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada,
335 Euclid Ave., Cleveland 14, Ohio.

Sheet-Metal Workers

(D.O.T. 4–80.010)

Nature of Work

Sheet-metal workers fabricate and install ducts which are used in ventilating, air-conditioning, and heating systems. They also fabricate and install a wide variety of other products made from thin metal sheets, such as roofing and siding, commercial stainless steel kitchen equipment, partitions, sheet-metal shelves in industrial establishments, store fronts, metal framework for neon signs, and materials chutes.

In heating or air-conditioning duct work, the sheet-metal worker lays out and plans the job, determining the size and type of sheet metal to be used. The ducts are often fabricated at the sheet-metal shop. In fabricating work, sheet-metal workers cut the metal with hand snips and power-driven shears, as well as other types of cutting tools. They form the metal with bending machines, hammers, and anvils, then weld, bolt, rivet, solder, or cement the seams and joints. However, prefabricated ducts in standard sizes are often available and these require little fabrication at the shop. Some duct fabrication is done at the work site in the installation process, especially on large sheet-metal jobs. In the installation, the component parts are fitted together and assembled. Hangers and braces are installed to support ducts, and joints may be soldered. Some journeymen workers specialize in shopwork or on-site installation work. However, it is essential that skilled workers know all aspects of the trade.

Where Employed

Sheet-metal workers are employed mainly by plants producing heating, refrigeration, and air-conditioning equipment and by contractors engaged in residential, industrial, and commercial building work. In residential construction, these workers may also work for roofing contractors who specialize in metal roofing.

In addition, many of these craftsmen work for government agencies or business establishments which do their own construction and alteration work. Others are self-employed, mainly on repair work or on smaller types of installations. Some craftsmen are employed in small shops manufacturing specialty products, such as custom kitchen equipment for hotels and restaurants.

Many skilled sheet-metal workers are also employed by railroad, aircraft, or shipbuilding companies. Firms making blowers, exhausts, electrical generating and distributing equipment, food products machinery, steam engines, and turbines also employ skilled sheet-metal workers. Skilled sheet-metal workers should not be confused with assembly-line factory operatives who also make sheet-metal products but are trained in only a few specific operations.

The jobs of the skilled sheet-metal workers are distributed throughout the country in about the same pattern as those of building trades workers generally. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4- or 5-year apprenticeship program as the best way to learn this trade. Some sheet-metal workers, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced craftsmen. Many of these persons have gained some knowledge of the trade by taking correspondence or trade school courses.

Apprenticeship applicants generally are required to be between the ages of 17 and 21; a high school education or its equivalent is desirable. Good physical condition and mechanical aptitude are necessary assets. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 8,000 to 10,000 hours (4 to 5 years) of on-the-job training, in addition to related classroom instruction. The following is a general summary of a typical apprenticeship work program for sheet-metal workers: Learns how to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; learns how to solder; learns general work processes such as cutting, forming, folding, grooving metal material, and bending edges, and punching and drilling holes; learns how to do air-conditioning, heating, and ventilating work; learns how to do residential installations such as roofing, gutters, and downspouts; and learns how to do architectural and industrial sheet-metal work.

The trainee also receives related classroom instruction in subjects such as drafting, blueprint reading, and mathematics applicable to layout work. In addition, he learns the relationship between sheet-metal work and other building trades.

Hourly wage rates for sheet-metal apprentices generally start at 50 percent of the journeyman rate and increase periodically until 90 percent of the journeyman rate is reached during the final portion of the apprenticeship training period. If apprenticeship applicants have had training or experience directly related to the trade, for example, as a result of training in sheet-metal work in a vocational school or experience in a factory or in the Armed Forces, they may be granted advanced apprenticeship standing.

Experienced sheet-metal workers have more job mobility than many other building trades workers because they can transfer their skills from the construction industry to the metal manufacturing industries. Also, they may advance to the position of foreman for a contractor, become superintendents of large projects, or enter business for themselves as sheet-metal contractors. Adequate financial resources and a sound knowledge of business principles and practices are usually basic requirements for success as a contractor.

Employment Outlook

Employment of sheet-metal workers is expected to increase significantly during the 1960's. However, because of the relatively small size of the occupation, there will be only a few thousand job opportunities each year for young men to enter this trade. In addition to job openings arising from the growth of the trade, many other job opportunities for new workers will result from the need to replace experienced sheet-metal workers who retire, die, or transfer to other fields of work.

The increase in the employment of sheet-metal workers is expected primarily as a result of the anticipated large expansion in new residential, commercial, and industrial construction in the 1960's. (See discussion, p. 284.) Moreover, the expected large increase in the number of permanently installed air-conditioning systems in residential, commercial, and factory buildings, will provide more work for sheet-metal workers. In addition, the manufacturing industries which employ skilled sheet-metal workers generally have favorable long-range prospects. The shops which fabricate sheet-metal products used in construction are also expected to require more skilled sheet-metal craftsmen in the next 10 years.

Prefabrication is not likely to affect the growth of employment in this occupation as much as in most other building trades, because of the custom nature of much of the work. The prefabrication of ducts and fittings for ventilating installations is limited by the need to tailor these installations to meet a wide variety of structural conditions, such as the dimensions of the building and the space allowed for ducts, and the cost of storage space needed to store prefabricated ducts and fittings.

Earnings and Working Conditions

The annual earnings for sheet-metal workers tend to be higher than for most other skilled building trades workers because the trade is less affected by seasonal factors.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for sheet-metal workers was $3.54. Among the individual cities, the union minimum hourly wage rates for sheet-metal workers ranged from $2.83 in Charlotte, N.C., to $4.10 in Newark and New York. (See table 2, p. 287, for union minimum hourly wage rates for sheet-metal workers, in each of the 52 large cities.)

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association. Union-employer contracts covering sheet-metal workers usually provide health insurance and pension benefits, financed either entirely by the employers or jointly by the workers and employers.

Many sheet-metal workers spend considerable time at the construction site, where they may work either indoors or outdoors. Other sheet-metal workers may work primarily indoors, doing fabricating and layout work.

When installing gutters, skylights, and cornices they may work high above the ground level. When installing ventilating and air-conditioning systems, they may work in awkward and relatively inaccessible places. Sheet-metal workers run the risks of cuts and burns from the materials, tools, and equipment used in their trade.

Where To Go for More Information

A young man who wishes to obtain information regarding sheet-metal apprenticeships or work opportunities in this trade should contact sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the Sheet Metal Workers' International Association; or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Further information may be obtained from:

Sheet Metal and Air Conditioning Contractors' National Association, Inc.,
170 Division St., Elgin, Ill.

Sheet Metal Workers' International Association,
1000 Conn. Ave. NW., Washington 6, D.C.

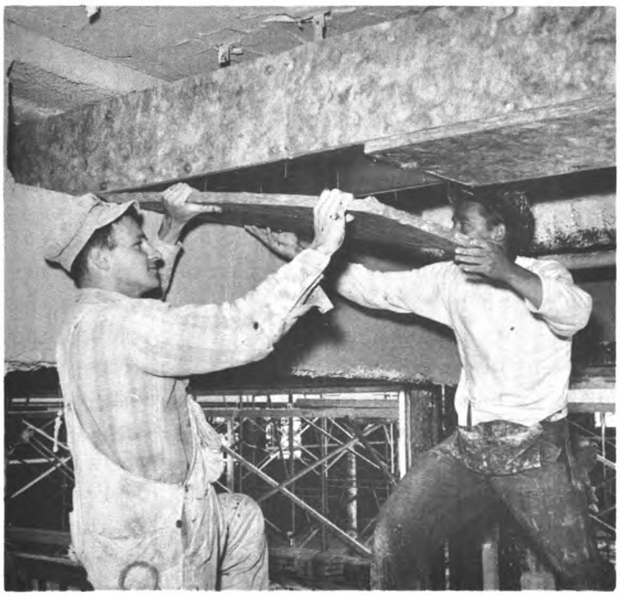
Asbestos and Insulating Workers

(D.O.T. 5–33.110 and .210)

Nature of Work

The principal work of asbestos and insulating workers is to cover pipes, boilers, and other equipment with insulating materials, such as cork, felt, asbestos, fiberglass, and magnesia. These materials are installed by pasting, wiring, taping, stud-welding, spraying, or other methods. Asbestos and insulating workers use handtools, such as trowels, brushes, scissors, hammers, saws, pliers, and stud-wielding guns. Powersaws are also used to cut insulating materials.

The insulating materials which these workers install serve many purposes. For example, the insulation of pipes, tanks, vats, ducts, stills, towers, boilers, and furnaces retains heat and thus saves fuel. Another function of these materials is to insulate the piping in refrigeration systems to prevent the absorption of heat.



Asbestos workers applying flat block to metal ducts.

Where Employed

Most asbestos workers are employed by insulation contractors in new industrial and commercial construction. A substantial number are also employed in alteration and maintenance work. Chemical plants, petroleum refineries, rubber plants, atomic energy installations, shipyards, and other industrial establishments which have extensive steam installations for power and heating, employ asbestos workers for alterations and maintenance of their insulated pipework. Similarly, some large establishments which have cold storage facilities employ asbestos workers for maintenance work. Asbestos workers are found in almost every part of the country, with large concentrations in the more highly populated and industrialized centers. (See discussion, p. 281.)

Training, Other Qualifications, and Advancement

Most asbestos workers learn their trade through a 4-year "improvership" program that is similar in many respects to apprenticeship programs found in other building trades. The improvership program consists of a specified period of on-the-job training in which the new worker learns how to handle the tools of the trade and to work with the various kinds of insulating materials.

Applicants for improvership programs are generally required to be between the ages of 18 and 30 and in good physical condition. Hourly wage rates under the improvership programs start at about 50 percent of the journeyman's rate and, if the trainee's work progresses satisfactorily, increase by 10 percent each year until 80 percent of the journeyman rate is reached during the final stage of the program. At the end of the 4-year improvership program, trainees are required to pass an examination which demonstrates their knowledge of the trade.

A skilled asbestos worker may advance to the job of foreman, shop superintendent, or estimator, or he may open his own insulation contracting business.

Employment Outlook

Employment in this relatively small building trade is expected to increase rapidly during the 1960's as a result of the anticipated sharp rise in the volume of construction of commercial and industrial buildings. (See discussion, p. 284.) Moreover, the increasing use of industrial pipe, required for numerous manufacturing processes, such as those found in the petroleum and chemical industries and in industries where refrigeration and air-conditioning installations are used, will require increasing numbers of asbestos workers for installation and maintenance work. In addition to job openings resulting from the growth of the trade, other job opportunities will be created by the need to replace workers who retire, die, or transfer to other fields of work. The expected growth and replacement needs in this relatively small field of work will create about 1,000 to 1,500 job openings annually during the 1960's.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for asbestos workers was $3.64, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for asbestos workers ranged from $3.13 in Richmond, Va., to $4.30 in New York. (See table 2, p. 286, for union minimum hourly wage rates for asbestos workers, in each of the 52 large cities.)

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers. Union-employer contracts covering asbestos workers usually provide health insurance and pension benefits, financed entirely by employers.

Where To Go for Information

A young man who wishes to obtain further information regarding asbestos workers' improvership programs or work opportunities in this trade should apply to an asbestos contractor in his area or to a local of the International Association of Heat and Frost Insulators and Asbestos Workers.

Additional information may be obtained from:

Insulation Distributor Contractors National Association, Inc.,
1632 K St. NW., Washington 6, D.C.

International Association of Heat and Frost Insulators and Asbestos Workers,
1300 Connecticut Ave. NW., Washington 6, D.C.

Lathers

(D.O.T. 5-32.761, .762, and .763)

Nature of Work

Lathers install the supporting backings on ceilings or walls on which plaster or other materials are applied. These backings are usually metal lath (pieces of iron or light iron that often resemble wire netting), or large pieces of perforated gypsum board.

When installing metal lath, the lathers first build a light iron framework (furring) which is fastened securely to the framing. The lath is then attached to the furring by nailing, clipping, or tying. After the lath has been installed, the lathers cut openings in it for electrical outlets and heating and ventilating pipes. This method of installation varies somewhat in other types of lath work. For example, for plaster cornices, the lather builds a framework that approximates the desired shape or form of the cornice. He then attaches metal lath to the framework. Gypsum lath is nailed on studs or clipped to the iron furring. Lathers also install corner beads (metal reinforcement used as corner protection) and similar supplementary items. When stucco is to be applied over wood framework, the lather nails coarse mesh wire to the framework, preparatory to plastering.

The tools of the trade include measuring rules and tapes, drills, hammers, chisels, hacksaws, shears, wirecutters, boltcutters, punches, pliers, and hatchets.

Where Employed

Most lathers work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. Some lathers are also employed outside the construction industry; for example, they make the lath backing for plaster display materials or scenery. Most of the estimated 20,000 lathers employed in mid-1958 had jobs in the larger urban areas.

Training and Other Qualifications

Completion of a 2- or 3-year apprenticeship program for lathers is recommended by training authorities generally as the best way to learn this trade. Many lathers, particularly in small communities, have learned the trade informally. They have picked up the trade by working for several years as helpers, observing or being taught by experienced lathers.

Apprenticeship applicants generally are required to be between the ages of 16 and 26, and in good physical condition. Aptitude tests are often given to applicants to determine their manual dexterity as well as the other qualifications required for this trade. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Apprentices generally must pass examinations which are given at the end of each 6-month period. Generally the apprentice is covered by a union apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

During the apprenticeship period, the apprentice learns how to use and handle the tools and materials of the trade. For example, the apprentice installs gypsum and composition board, wall furring, and metal lathing. In addition, the apprentice generally receives related instruction in subjects such as applied mathematics, geometry, reading of blueprints and sketches, welding, estimating, and safety practices. Although a high school education is not required, education above grade school level, particularly courses in mathematics, is needed to understand the classroom instruction.

Hourly wage rates for lather apprentices generally start at 50 percent of the journeyman rate. The rate is increased periodically by 5 percent every third or fourth month until a rate of 85 percent is reached in the final quarter of the second year of training.

Employment Outlook

A moderate increase in employment in this relatively small building trade is expected in the 1960's. The growth of the trade will result principally from the anticipated large expansion in construction activity. (See discussion, p. 284.) Moreover, there will be a growing need for lathing work because of the increased use of acoustical tile for sound insulation, the trends toward suspended and other decorative types of ceilings, and the increased use of lightweight plasters as a fireproofing material for structural steel. These developments may largely offset the loss of lathing work resulting from the increasing use of dry walls, particularly in residential construction where these materials are often installed by carpenters. In addition to the expected employment increase, a few job openings will result from the need to replace workers who retire, die, or transfer out of the trade.

Earnings and Working Conditions

The average hourly wage rates for lathers are among the highest in the skilled building trades. However, because of the seasonal nature of their work, their average annual earnings are lower than the hourly rates would appear to indicate.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for lathers was $3.72, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for lathers ranged from $2.72 in Memphis to $4.10 in Los Angeles. (See table 2, p. 286, for union minimum hourly wage rates for lathers, in each of the 52 large cities.)

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union. Union-employer contracts covering lathers usually provide health, life insurance, pension, and other benefits, financed either entirely by employers or jointly by the workers and employers.

Where To Go for More Information

For further information regarding lathers' apprenticeships or work opportunities in the trade, a young man should apply to a lathing contractor in his area, a local of The Wood, Wire and Metal Lathers International Union, or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Contracting Plasterers' and Lathers' International Association,
711 14th St. NW., Washington 5, D.C.

National Bureau for Lathing and Plastering,
311 Tower Bldg., 1401 K St. NW., Washington 5, D.C.

The Wood, Wire and Metal Lathers International Union,
7214 New Hampshire Ave. N.W., Takoma Park 12, Md.

Marble Setters, Tile Setters, and Terrazzo Workers

(D.O.T. 5–24.310, .410, and .510)

Nature of Work

Marble setters, tile setters, and terrazzo workers cover interior or exterior walls, floors, or other surfaces with marble, tile, or terrazzo. These are distinct trades. Craftsmen in each trade work primarily with the material indicated by their title.

The tile setter attaches tile (a thin slab of baked clay, stone, or other material) on walls, floors, or ceilings according to blueprints or other instructions. For walls and ceilings, a plaster coat and then a layer of cement are applied to the surface or other supporting backing, such as plaster board or metal lath. The tiles are then tapped into place with a trowel or handle. In laying tile floors, the tile setter adds cement to the fresh concrete subfloor and then lays the tile. He chips the tile with a hammer and chisel or cuts it with a blacksmith's pincers to make it fit into irregular areas, into corners, or around pipes.

Small tiles, such as those laid in bathrooms, are available in paperbacked strips and sheets that can be fastened to the floor as a unit, using cement, various types of adhesives, or mastic. This eliminates the need for the setting of individual tiles. The tile setter is usually assisted by a helper who mixes mortar, sets up scaffolds, supplies the setter with materials, fills the joints after the tile setting is completed, and cleans the completed work.

Terrazzo workers are skilled craftsmen who work with terrazzo which, essentially, is a type of ornamental, nonstructural concrete in which marble chips are used as the coarsest ingredient. The terrazzo is ground and polished after hardening to give a smooth surface in which the marble chips are exposed against the background of other materials.

A terrazzo worker starts his work by laying a base (first course) of fine, fairly dry concrete, leveling this accurately with a straightedge (a long flat board), and tamping it. He then places metal strips wherever there is to be a joint, or a change of color between panels and imbeds their bottom edges in the first course. If there is to be lettering or an ornamental figure, he also imbeds a shop-made mold. Then, he mixes the top course of concrete, pours it onto the base course, and rolls and levels it. There is, of course, a separate mixture for each color. After the concrete has hardened for a few days, a semiskilled worker grinds and polishes the floor with an electric-powered grinding machine until the surface is smooth and level.

In these operations, the terrazzo worker is assisted by helpers in the mixing and placing of the base course, but he alone does the leveling and placing of the metal strips. Helpers handle sand, cement, marble chips, and all other materials that may be used by the terrazzo workers. They rub and clean all marble, mosaic, and terrazzo floors and perform other work required in helping a terrazzo mechanic. The terrazzo worker generally supervises mixing of the top course which, along with the grinding, governs its final appearance.

Marble setters install marble, shop-made terrazzo panels and artificial marble, and structural glass when it is used in the interior of a building. The marble setter does little fabrication work because the marble and other materials are cut to size and polished before they are delivered to the work site. However, he may have to do some

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minor cutting to make the materials fit exactly. In setting marble, he lays out the work, then applies a special plaster mixture to the backing material and sets the marble pieces in place. When necessary, he braces them until the setting plaster has hardened. Special plaster is poured into the joints between the marble pieces, and the joints are pointed up (slightly indented) with a trowel or wooden paddle. Bolt holes may have to be drilled if attachments to the marble are necessary. Usually, each marble setter has a helper or general assistant to prepare plaster, help carry marble slabs, and clean the surface of the completed work.

Where Employed

Marble setters, tile setters, and terrazzo workers are employed mainly in new building construction and generally in the larger urban areas. Significant concentrations of terrazzo workers are found in Florida and California.

Training, Other Qualifications, and Advancement

Completion of a 3-year apprenticeship program in each of these distinct trades is recommended by training authorities generally as the best way to learn these trades. A substantial proportion of tile setters, terrazzo workers, and marble setters, however, have learned these trades informally. They have picked up the trade by working several years as helpers, observing or being taught by experienced craftsmen.

Apprenticeship applicants generally are required to be between the ages of 17 and 22; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important aspects. Applicants should have an eye for quickly determining proper alinements of tile, terrazzo, and marble, and a good sense of color harmony.

Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training. The apprenticeship programs in each of these trades generally consist of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. The following is a general summary of a typical 3-year terrazzo apprenticeship work program: Learns how to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; learns the selection and placement of materials according to design of job; learns how to mix, place, tamp, and level terrazzo material and concrete; learns how to select, set, and level metal dividing strips; learns the placing, screeding, and tamping of terrazzo mix; learns rough screeding and rounding of bases and coves; and learns finishing of base and cove and hand and machine rubbing.

The apprentice also receives related classroom instruction in blueprint reading, layout work, basic mathematics, and the making of measurement sketches.

Hourly wage rates for apprentices in each of these trades start at about 50 or 60 percent of the journeyman rate and increase periodically until 95 percent of the journeyman rate is reached during the last period of apprenticeship training.

Skilled and experienced tile, terrazzo, or marble setters may become foremen. Others are able to start their own small contracting businesses.

Employment Outlook

Employment in these small trades is expected to increase somewhat during the 1960's, primarily because of the anticipated large growth in new building construction. (See discussion, p. 284.)

Job openings for terrazzo workers are expected to increase faster than for marble setters and tile setters. Because terrazzo is durable and attractive, the number of terrazzo installations, particularly for floors, has expanded in the postwar period. There has been a shortage of highly skilled terrazzo workers in the postwar period and, as a result, some of these craftsmen have been recruited from abroad. The anticipated growth in employment of tile setters will be limited by the increased use of competing materials, such as asphalt floor tile, structural glass, plastic tile, and plastic-coated wallboard.

Little change in the employment of marble setters is expected. Despite the relatively higher costs of marble compared with competitive materials and the gradual depletion of the supply of quality marble, the excellent qualities of marble as a building material will insure its continued use and provide work for marble setters.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate was $3.62 for marble setters and terrazzo workers, and $3.50 for tile setters, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates ranged from $2.75 for marble setters, terrazzo workers, and tile setters in San Antonio to $3.85 for tile setters in Peoria, Ill., $3.95 for marble setters in Grand Rapids, Mich., and New York, and $4.10 for terrazzo workers in Newark and New York. (See table 2, p. 286, for union minimum hourly wage rates for marble setters, terrazzo workers, and tile setters, in each of the 52 large cities.)

A large proportion of the workers in each of these trades are members of one of the following unions—Bricklayers, Masons and Plasterers International Union of America; International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers & Terrazzo Helpers; and Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada. Union-employer contracts covering these workers usually provide insurance and pension benefits, financed either entirely by the employers or jointly by the workers and employers.

Marble setters and terrazzo workers work both indoors and outdoors, depending on the type of installation. Tile setters work mostly indoors.

Where To Go for More Information

To obtain further information regarding apprenticeships or work opportunities in these trades, a young man should apply to tile, terrazzo, and marble setting contractors in his area or to locals of the unions mentioned above. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D.C.

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers & Terrazzo Helpers,
815 15th St. NW., Washington 5, D.C.

National Terrazzo and Mosaic Association, Inc.,
711 14th St. NW., Washington 5, D.C.

Operative Plasterers' and Cement Masons' International Association of the U.S. and Canada,
335 Euclid Ave., Cleveland 14, Ohio

Tile Contractors' Association of America,
1420 New York Ave. NW., Washington 5, D.C.

Glaziers

(D.O.T. 5–77.010)

Nature of Work

Glaziers cut, fit, and install plate glass (for store windows), ordinary window glass, mirrors, and special items such as preassembled stained glass or leaded glass panels. In making a glass installation, the glass is first cut to size. The glazier puts a bed of putty into the wood or metal sash and presses the glass into place. He fastens the glass with wire clips or triangular metal points and then places and smooths another strip of putty on the outside edges of the glass to keep out moisture.

When installing structural glass, which is used to decorate building fronts, walls, ceilings, and partitions, the glazier (and sometimes the marble setter, see discussion, p. 321) applies mastic cement to the supporting backing and the glass is pressed into it. The glass may have to be trimmed with a glass cutter if it is not precut to specifications. Glaziers (as well as bricklayers, see p. 297) install glass blocks for building exteriors, interior partitions, and walls.

In addition to handtools, such as glass cutters and putty knives, glaziers use power cutting tools and grinders.

Where Employed

In mid-1958, only a few thousand glaziers were employed by glazing contractors on new construction, alterations and modernizations, and replacement of broken glass, particularly for store windows. Others were employed by government agencies or business establishments which do their own construction work.

A large number of glaziers work outside the construction industry. Many are employed in factories where they install glass in sash, doors, mirrors, and partitions. Other workers, using skills similar to those used by glaziers, install glass or mirrors in furniture and boats, or replace glass in automobiles.

Most glaziers are employed in large urban areas. In small communities, the work of the glazier is done by persons who also do painting or paperhanging.

Training and Other Qualifications

Completion of a 3-year apprenticeship program for glaziers is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of glaziers, however, have learned the trade informally. They have picked up the trade by working for several years and observing or being taught by experienced glaziers. In smaller communities, many journeymen painters and paperhangers have learned to do glazier work as part of the apprenticeship training for their trade.

Apprenticeship applicants generally are required to be at least 18 years of age; a high school education or its equivalent is desirable. Many glazier apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement, and the program is registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training. The apprenticeship program usually consists of 6,000 hours (3 years) of on-the-job training, in addition to a minimum of 144 hours a year of related classroom instruction. During the apprenticeship, the apprentice learns how to use and handle the tools, machines, and materials of the trade. The program also includes on-the-job experience in the installation of wood and metal sash (for example, doors, windows, and partitions); setting of store front openings, structural glass, mirrors, showcases, automobile glass, shower doors, and tub enclosures; replacement of glass; and scaffolding.

Hourly wage rates of glazier apprentices start at about 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of training. If apprenticeship applicants have had experience directly related to the trade, they may be granted advanced apprenticeship standing.

Employment Outlook

There will be only a few hundred opportunities each year for new workers to enter this relatively small field of work during the 1960's. The anticipated large expansion of construction activity in the 1960–70 decade (see discussion, p. 284) and the trend toward an increasing use of glass in buildings are expected to result in more glazing work. Replacement work and modernization work, frequently involving large glass installations, will continue to provide additional job opportunities for glaziers.

Earnings and Working Conditions

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for glaziers was $3.22. Among the individual cities, the union minimum hourly wage rates for glaziers ranged from $1.90 in Richmond, Va., to $4.10 in New York. (See table 2, p. 286, for union minimum hourly wage rates for glaziers, in each of the 52 large cities.)

A large proportion of glaziers employed in construction work are members of the Brotherhood of Painters, Decorators and Paperhangers of America. Union-employer contracts covering glaziers usually provide health insurance and pension benefits, financed either entirely by the employers or jointly by the employers and workers.

Where To Go for More Information

A young man who wishes to obtain further information regarding glazier apprenticeships or work opportunities in this trade should contact a glazing contractor or general contractor in his area, a local of the Brotherhood of Painters, Decorators and Paperhangers of America, or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Further information may be obtained from:

Brotherhood of Painters, Decorators and Paperhangers of America,
217–219 North 6th St., Lafayette, Ind.

Elevator Constructors

(D.O.T. 5–83.350 through .359)

Nature of Work

Elevator constructors (elevator mechanics) assemble and install elevators, escalators, dumb waiters, and similar equipment. The work is done by small crews (seldom more than six men) consisting of journeymen (skilled) mechanics and helpers.

In elevator construction work, the crew first installs the guide rails of the car in the elevator shaft of the building. Then they install the car frame and platform, the counterweight, the elevator chassis, and the control apparatus. Next, the car frame is connected to the counterweight with cables, the cab body and roof are installed, and the control system is wired. Finally, the entire assembly including cables, wire, and electrical control apparatus is carefully adjusted and tested.

Modernization, maintenance, and repair are important parts of the work of elevator constructors. In maintenance and repair work, these workers inspect elevator and escalator installations periodically and, when necessary, adjust cables and parts and lubricate or replace parts. Alteration work on elevators is important because of the rapid rate of innovation and improvement in elevator engineering. This work is similar to new installation work because all elevator equipment except the old rail, car frame, platform, and counterweight are generally replaced.

In order to install and repair electrical, hydraulic, steam, or compressed air elevators, many of which are electrically controlled, these workers must have a working knowledge of electricity, electronics, and hydraulics. They must also be able to repair electric motors and control and signal systems. Because of the variety of their work, they use many different handtools and power tools.

Where Employed

Most of the estimated 10,000 journeymen elevator constructors employed in mid-1958 worked for elevator manufacturers, doing new installation and modernization work and elevator servicing. Some elevator constructors are employed by small, local contractors who specialize in elevator maintenance and repair. Others work for government agencies or business establishments which do their own elevator maintenance and repair. Elevator constructors are also employed as elevator inspectors for municipal or other governmental licensing and regulatory agencies. The jobs of elevator constructors are concentrated in the highly industrialized and populated centers of the country. (See discussion, p. 281.)

Training and Other Qualifications

Although elevator constructors are among the more highly skilled building craftsmen, training is comparatively informal and is obtained through employment as a helper for a number of years. The helper-trainee must be at least 18 years of age, in good physical condition, and have a high school education or its equivalent, preferably including courses in mathematics and physics. Mechanical aptitude and an interest in machines are important assets.

Generally, at least 2 years of continuous job experience, including 6 months' on-the-job training at the factory of a major elevator firm, is necessary to acquire a journeyman's skill. During this period, the helper must learn to perform all of the operations involved in the installation, maintenance, and repair of elevators, escalators, and similar equipment. The helper-trainee is generally required to attend evening classes in vocational schools. Among the subjects studied are mathematics, physics, electrical and electronic theory, and proper safety techniques.

Opportunities for establishing an individually owned small contracting business in this field are very limited.

Employment Outlook

Continued increase in the rate of employment growth for elevator constructors is expected during the 1960's. However, because of the small size of this occupation there will only be several hundred job openings annually for new workers in this trade.

Increasing numbers of elevator constructors will be needed as the result of the anticipated large expansion in new industrial, commercial, and large residential building. Modernization of older elevator and escalator installations will also contribute to the growing need for these workers. Technological advances in elevator and escalator construction will result in more work for these craftsmen. The modern high-speed, complex elevators, with their automatic door openings and automatic leveling at floors, require more work and higher skill for the installation and adjustment of electrical and electronic controls.

Earnings and Working Conditions

Both the hourly wage rates and the annual earnings of elevator constructors are among the highest in the skilled building trades. These craftsmen lose less worktime because of seasonal factors than do most other building trades workers.

The wage rates paid to most elevator constructors are based on an agreement between the International Union of Elevator Constructors and the major elevator manufacturers. This agreement provides that the local wage rates for elevator mechanics shall be the average of the wage rates paid in the area to the five highest paid of the following buiding trades: Bricklayers, plasterers, carpenters, electricians, sheet metal workers, plumbers and steamfitters, and iron workers. Helpers' rates generally are 70 percent of the journeymen's rates.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for elevator constructors was $3.67, compared with $3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rates for elevator constructors ranged from $3.20 in Little Rock to $4.24 in Newark and New York. (See table 2, p. 286, for union minimum hourly wage rates for elevator constructors, in each of the 52 large cities.)

Most elevator constructors are members of the International Union of Elevator Constructors. Union-employer contracts covering elevator workers usually provide health insurance, financed either entirely by employers or jointly by the employers and workers.

Some work operations in elevator construction involve manual labor, but this is usually done by the helpers. Also, much of the work must be done in cramped or awkward positions. The work is done indoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding work opportunities as a helper in this trade should contact an elevator manufacturer, an elevator contractor, or a local of the International Union of Elevator Constructors, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for work opportunities in this trade.

Additional information may be obtained from:

International Union of Elevator Constructors.
12 South 12th St., Philadelphia 7, Pa.

Stonemasons

(D.O.T. 5–24.210)

Nature of Work

Stonemasons build the stone exteriors of structures. They work primarily with two types of stones—natural cut stone, such as marble, granite, or sandstone; and artificial stone which is made to order for industrial buildings. These craftsmen use the same skills and techniques whether they work with natural cut stone or artificial stone.

Much of the work of these craftsmen is the setting of natural cut stone for comparatively expensive buildings such as offices, hotels, churches, and public buildings. In this type of work, the stonemason works from a set of drawings in which each stone has been numbered for identification purposes, except where every piece is identical. A helper or derrickman locates the pieces needed and brings them to the mason; larger stones are set in place with a hoist. The stonemason sets the stone in mortar and moves it into final position with a mallet, hammer, or crowbar. He alines the stone with a plumb line and finishes the joints between the stones with a pointing trowel. He may fasten the stone to supports with metal ties or anchors.

Occasionally, the stonemason may have to cut stone to size. To do this, he must determine the grain of the stone selected and strike blows along a predetermined line with a stonemason's hammer. More valuable stones are cut with an abrasive saw to make them fit.

Stonemasons also do some stone veneer work, in which a thin covering of cut stone is applied to the exterior surfaces of a building. In one specialized branch of the trade known as alberene stone setting, stonemasons set acid-resistant soapstone linings for vats, tanks, and floors.

The principal handtools of the stonemasons are heavy hammers, wooden mallets, and chisels. For rapid stone cutting, pneumatic tools are used, such as pneumatic hammers, pneumatic drills, and brushing tools. Special power tools are used for smoothing the surface of large stones. For cutting, an abrasive saw is used on mortar and sandstone.

Where Employed

Most stonemasons work on new building construction, particularly on the more expensive residential and commercial buildings. A few work for government agencies or business establishments which do their own construction and alteration work. Journeymen stonemasons are employed mainly in the larger urban areas. In many areas where there are no stonemasons, the work is performed by bricklayers who can do stone masonry work.

Training and Other Qualifications

Completion of a 3-year apprenticeship program for stonemasons is recommended by training authorities generally as the best way to learn this trade. However, a substantial proportion of stonemasons have picked up the trade by working several years as helpers, observing or being taught by experienced stonemasons.

Apprenticeship applicants generally are required to be between the ages of 17 and 24; a high school education or its equivalent is desirable. Good physical condition is an important asset.

The apprenticeship training program for stonemasons generally requires 6,000 hours (3 years) of on-the-job training in the use and handling of the tools, machines, and materials of the trade. During the apprenticeship, the trainee learns how to lay out and install walls, floors, stairs, and arches; and how to work with the various kinds of natural and artificial stone. The apprenticeship training program in this occupation is similar to that for bricklayer. (See discussion, p. 298.)

Employment Outlook

Little increase in the employment of stonemasons is expected during the 1960's, despite the anticipated large expansion in new building construction. Less use of stone masonry work is expected, because modern architectural design has emphasized simpler lines and less ornamentation, and larger window areas. Replacement needs will provide a small number of job opportunities for new workers each year in this relatively small building trade.

Earnings and Working Conditions

Hourly wage rates for stonemasons are among the highest in the skilled building trades. Their average annual earnings, however, are much less than their hourly rates would indicate, since these workers lose much worktime because of weather conditions and the brief duration of jobs.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate for stonemasons was \$3.77, compared with \$3.54 for all journeymen in the building trades. Among the individual cities, the union minimum hourly wage rate for stonemasons ranged from \$3.35 in Jacksonville to \$4.30 in Newark. (See table 2, p. 287, for union minimum hourly wage rates for stonemasons, in each of the 52 large cities.)

A large proportion of stonemasons are members of the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering stonemasons usually provide health insurance and pension benefits, financed either entirely by employers or jointly by the workers and employers.

Most stonemasonry work is done outdoors. The work of the stonemason is active and sometimes even strenuous, as it involves lifting moderately heavy materials.

Where To Go for More Information

A young man who wishes to obtain further information regarding apprenticeships for stonemasons or work opportunities in this trade should apply to bricklaying contractors in his area, to a local of the Bricklayers, Masons and Plasterers International Union of America; or to a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service serves as a source of information and a contact point for apprenticeship openings.

Additional information may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington 6, D.C.

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. N.W., Washington 5, D.C.

Construction Laborers and Hod Carriers

(D.O.T. 9–32.01)

Nature of Work

Laborers on building construction and other types of construction (such as highways, sewers, water projects, and engineering construction) do work which requires no formal training. Among the principal types of work done by construction laborers are shoveling and grading of earth and carrying materials to the location where they are needed, by hand or by wheelbarrow. Laborers may also move the smaller units of machinery and equipment. They often set bracings and supports in place at the sides of excavations to prevent the collapse of trenches. Where concrete is mixed at the job, they fill the mixer with ingredients and, if already mixed, even help pour the concrete, spread it, and spade it, to prevent air pockets. They do the general cleaning up of rubble at successive stages in construction. In alteration and modernization work, they tear out the old work. In concrete highway paving, laborers handle and place the forms for the concrete, set up and move the hose to supply the concrete mixer with water, and cover new pavement to prevent excessive drying during the "curing" period.

Bricklayers' helpers and plasterers' tenders, both commonly known as hod carriers, serve journeymen in their respective trades, supplying them with materials, setting up and moving portable scaffolding, and providing the other services needed by these journeymen. The duties of hod carriers require familiarity with the work of the journeymen, some knowledge of the materials used, and some degree of judgment. It is customary practice in the building trades for hod carriers to be transferred, along with the journeymen helpers, from one construction project to another.

Construction laborers are commonly classified as unskilled workers, but this term can be misleading. Their work covers a wide range of requirements; in many of the operations, experience is valuable and in some of them skill is necessary. Some types of construction laborer and hod carrier jobs often require experience as well as a broad knowledge of construction methods, materials, and operations. Rock blasting is an example of a type of work in which "know-how" is important. In order to set the blasting charge properly, the laborer must have a knowledge of the various rock layers and considerable experience in handling dangerous explosives. Also, in the construction of tunnels and caisson foundations, construction laborers must have specific on-the-job experience. They do all the work back of the air lock, including operations which would be done by journeymen if the job were located elsewhere.

Where Employed

Laborers and hod carriers are employed by all types of construction contractors on almost every kind of building, road, and engineering project. A large number of these workers are also employed by State and municipal public works and highway departments and by public utility companies in road repairing, maintenance-of-way work, and excavating.

The more than 700,000 construction laborers and hod carriers at work in mid-1958 were employed in every section of the country. The employment of these workers is distributed geographically in much the same way as building trades employment generally. (See discussion, p. 281.)

Training and Other Qualifications

No formal training is required to obtain a job as a construction laborer. Generally, to be employed as a construction laborer, a young man must be at least 16 years of age and in good physical condition. A laborer's first job is usually on the simplest type of work, but as he gains experience he does more difficult work. Although laborers work with skilled building craftsmen, they rarely have a chance to work with the journeyman's tools or equipment and, therefore, generally have little opportunity to pick up the skills of a building trade.

Employment Outlook

Continued increase in employment for construction laborers is expected during the 1960's as a result of the anticipated large growth in the volume of construction activity. (See discussion, p. 284.) However, increased mechanization and improved methods of materials handling will limit the rate of growth in the employment of these workers. For example, the employment of laborers is being affected by the increasing use and the development of new types of more efficient grading machinery and mechanical lifting devices and by the wider use of easily assembled metal scaffolding.

Earnings and Working Conditions

The average hourly wage rates for construction laborers and bricklayers' tenders are generally higher than those for unskilled or semiskilled production workers in manufacturing. However, because of the seasonal nature of much of construction work and because of worktime lost for other reasons, the average annual earnings of laborers and bricklayers' tenders are not as high as their hourly rates of pay would indicate.

The U.S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage scales in the building trades showed that, as of July 1, 1958, in 52 large cities surveyed, the average hourly rate was $2.47 for building laborers and $2.68 for bricklayers' tenders. Among the individual cities, the union minimum hourly wage rates ranged from $1.20 for building laborers in Jacksonville and $1.34 for bricklayers' tenders in Charlotte, N.C., to $3.35 for both building laborers and bricklayers' tenders in Newark and New York. (See table 2, p. 287, for union minimum hourly wage rates for building laborers and bricklayers' tenders, in each of the 52 large cities.)

The work of construction laborers and hod carriers is generally physically strenuous and requires bending, stooping, and heavy lifting. Much of the work is performed outdoors. Many laborers and hod carriers are members of the International Hod Carriers', Building and Common Laborers' Union of America.

Where To Go for More Information

A young man who wishes to obtain further information regarding work opportunities as a construction laborer or hod carrier should contact a construction contractor in his area, or a local of the International Hod Carriers', Building and Common Laborers' Union of America, if there is one in his area. In addition, the local office of the State employment service is a source of information and a contact point for such work opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc.,
1957 E St. NW., Washington 6, D.C.

International Hod Carriers', Building and Common Laborers' Union of America,
821 15th St. NW., Washington 5, D.C.

PRINTING (GRAPHIC ARTS) OCCUPATIONS

The printing crafts provide a large field of employment for skilled workers in the United States. In 1958, about 320,000 workers were employed in the unique printing crafts as compositors, typesetters, photoengravers, electrotypers, stereotypers, pressmen, lithographic workers, and bookbinders. These trades offer especially good opportunities for young men willing to spend several years in learning a skilled craft. Skilled printing workers generally have year-round employment and much better than average earnings. Jobs are to be found throughout the country, in small towns as well as big cities. Some printing craftsmen also have opportunities to go into business for themselves.

Nature and Location of the Industry

Basically, printing is a means of transferring ink impressions of type, photographs, and illustrations from a press plate to paper, metal, or other materials. The printing process is used mainly by the printing (graphic arts) industry—one of the Nation's major manufacturing industries. The more than 32,000 printing and publishing establishments employed about 265,000 printing craftsmen in 1958. Government agencies and business establishments that do their own commercial printing—such as paper box manufacturers—employed an estimated additional 55,000 printing craftsmen.

The printing industry may be classified into a number of segments. The largest, in terms of the number of jobs provided for printing craftsmen, is made up of more than 12,000 "job" (commercial) shops which produce such printed matter as letterheads, business forms, advertising matter, folders, and pamphlets. With few exceptions, job shops print by the letterpress process; however, many of them have established lithographic (offset) departments in recent years. Commercial shops also print books, periodicals, limited-run newspapers, and magazines. More than one-half of all workers employed in job shops are in plants with less than 100 workers. A few large printing plants which employ more than a thousand workers each and compete for business on a State or national basis account for about one-sixth of all commercial printing employees.

Newspapers provide the second largest employment field for printing craftsmen. A great majority of the approximately 1,800 daily and 9,000 weekly newspapers throughout the Nation do their own printing. Although some major metropolitan newspapers employ as many as several hundred craftsmen, many smaller dailies and weeklies employ fewer than 15 skilled workers.

The third largest area of employment for craftsmen is in the lithographic segment of the industry. Lithographic plants produce items similar to those of commercial letterpress plants, but differ from letterpress in the type of printing method used. About two-thirds of the employment in the lithographic industry is located in plants with 50 or more employees.

Binderies which assemble printed materials into books, folders, magazines, and pamphlets also provide many jobs for craftsmen.

Other segments of the printing industry employing many craftsmen include firms such as those specializing in books, magazines, and greeting cards. In addition, many shops perform service functions, such as photoengraving, typesetting, electrotyping, and offset platemaking for printing establishments, advertising departments of large firms, and advertising agencies.

Printing jobs are found throughout the country. Almost every small town has a printing shop of some kind—frequently, a small newspaper plant which also may handle the community's job printing. However, more than half of the Nation's printing employees are in five States—New York, Illinois, California, Pennsylvania, and Ohio. Within these States, printing activities are predominantly in or near areas with heavy concentrations of manufacturing, commercial, or financial activity, such as New York City, Chicago, Philadelphia, Cincinnati, Cleveland, Los Angeles, and San Francisco. Other leading printing centers are Boston, Newark, Detroit, St. Louis, Minneapolis-St. Paul, Milwaukee, and Washington, D.C. Job and periodical printing is highly concentrated in these major urban areas. A much larger proportion of jobs in newspaper plants is found outside these centers because of the great numbers of small local newspapers scattered throughout the country.

Printing Processes

A description of the various printing processes is essential to an understanding of the work performed by the printing crafts. Three printing processes are in general use today—letterpress, lithography (offset printing), and gravure. A fourth method, the screen process, although much less extensively used than the other three methods, is increasing in importance. Each method of reproduction has its own special advantages and requires different types of skilled craftsmen.

In letterpress (relief) printing, the letters and designs to be reproduced are raised above the nonprinting areas of the press plate. When the actual printing is done, ink is applied only to the raised area of the plate by means of an inking roller. Letterpress is the oldest and by far the most common printing process. Practically all newspapers, the bulk of books, magazines, and a substantial portion of other printed items are produced by this method. The letterpress process also includes photoengraving (the photomechanical production of plates for illustrations and other copy that cannot be set up in type) and stereotyping and electrotyping (the production of metal, plastic, or rubber duplicate press plates).

The press plate used in lithography is smooth, with both the image and nonimage areas on the same level, instead of on different levels as in the letterpress and gravure processes. Lithography is based on the principle that grease and water repel each other. The image areas of the plate are coated with a greasy substance to which the greasy printing ink will stick. On the press, before each inking, the plate is moistened with water, so that only the image areas take up the greasy ink from the inking roller. In modern lithography, the plates are produced photomechanically, and the method is often referred to as photolithography. Lithography is predominantly used for calendars, maps, posters, and printing on metal. All items printed by the letterpress process can also be produced by lithography.

Gravure or intaglio printing is much less widely used than either the letterpress or lithographic method. In this process, the relative position of the printing and nonprinting areas of the plate is the reverse of that in letterpress. The letters and designs to be printed are etched (cut) into the plate and are below the nonprinting surface. Ink is applied to the entire plate, but the surface is then wiped or scraped, leaving ink only in the depressions. In printing, suction is created, which lifts the ink out onto the paper. Sunday newspaper supplements and mail-order catalogues are well-known examples of gravure printing. Gravure pictures also appear as inserts in many magazines as well as in other forms of printed material. Most printing on metal foil is done by this means.

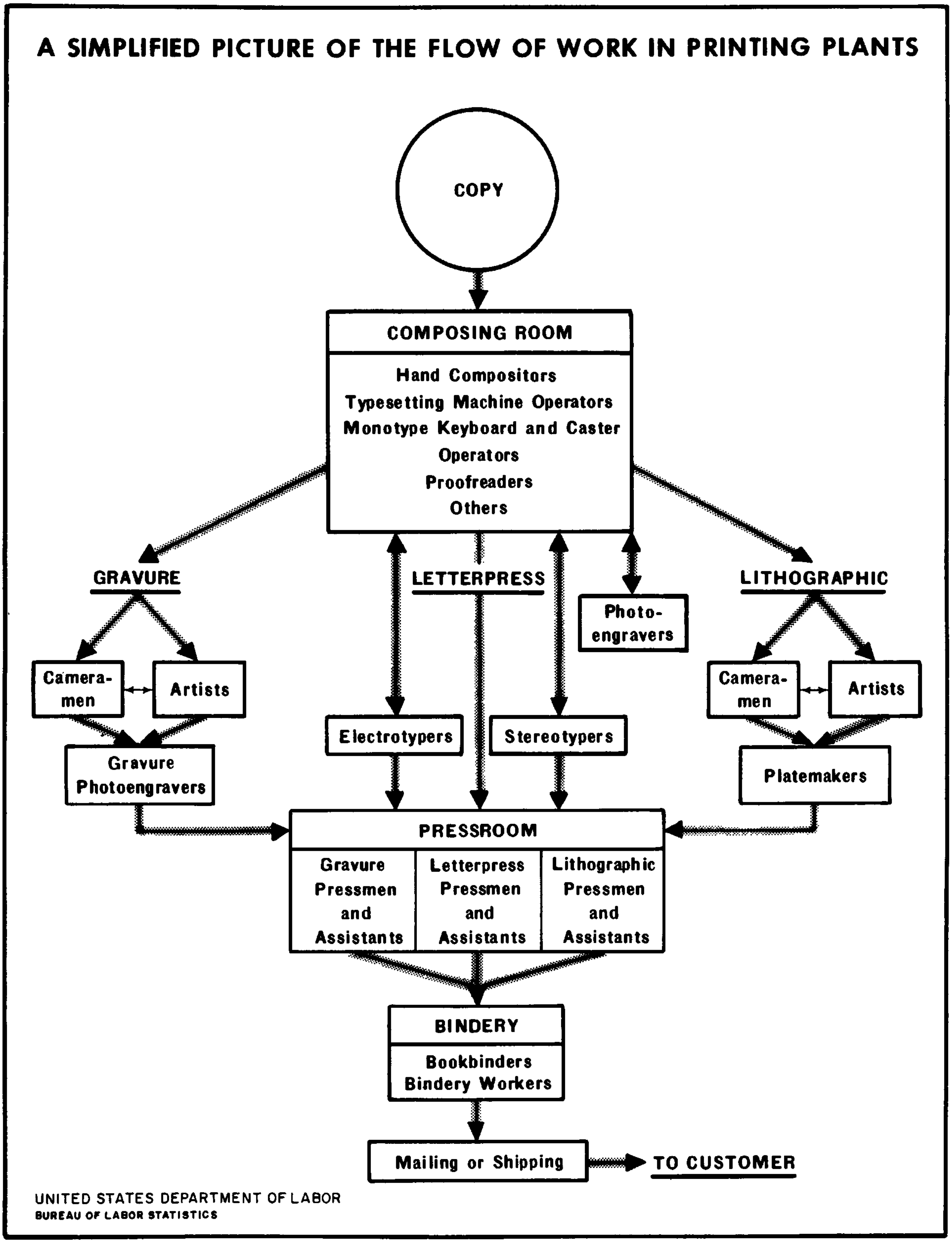
Screen printing is the process whereby paint is forced by a rubber squeegee through the mesh of a screen stretched over a printing frame, leaving a design on the surface being printed. The design is controlled by a stencil or pattern which may be made either by hand or by photographic methods.

Printing Occupations

Regardless of the process employed, most printing work goes through at least three stages: composition, platemaking, and presswork. (See chart 26.) Additional processing in a bindery is also needed for products that must be bound, such as books and magazines. In the past, many all-round printers could perform every operation in the printing process. Such craftsmen can still be found in small newspaper and job shops, but today printing craftsmen are usually more specialized, and, therefore, their training is directed to a specific area of printing operations—for example, type composition, photography, platemaking, or presswork. Training, moreover, is largely confined to only one of the basic printing methods—letterpress, gravure, or lithographic.

The largest group of skilled craftsmen is made up of all composing room workers, with about 180,000 employed in 1958. This group includes hand compositors, typesetting machine operators, Monotype keyboard operators, Monotype caster

CHART 26

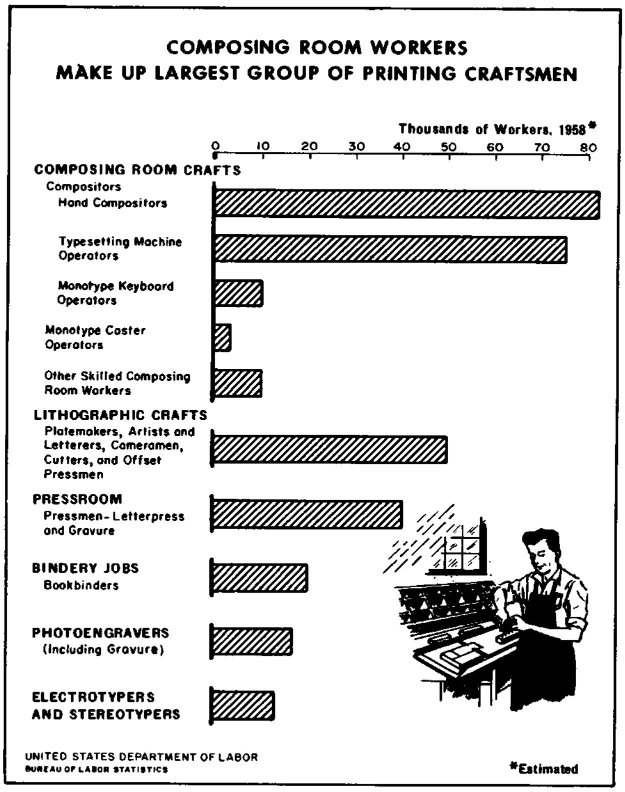

A SIMPLIFIED PICTURE OF THE FLOW OF WORK IN PRINTING PLANTS
COPY
COMPOSING ROOM
Hand Compositors
Typesetting Machine Operators
Monotype Keyboard and Caster Operators
Proofreaders
Others
GRAVURE
LETTERPRESS
LITHOGRAPHIC
Photo-engravers
Camera-men
Artists
Electrotypers
Stereotypers
Camera-men
Artists
Gravure Photoengravers
Platemakers
PRESSROOM
Gravure Pressmen and Assistants
Letterpress Pressmen and Assistants
Lithographic Pressmen and Assistants
BINDERY
Bookbinders
Bindery Workers
Mailing or Shipping
TO CUSTOMER
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

operators, Teletypesetters, photocompositors, and proofreaders. (See chart 27.) Lithographic craftsmen make up the second largest group of skilled printing workers, with more than 50,000 employed in 1958. Other important occupations are letterpress and gravure pressmen, electrotypers and stereotypers, photoengravers, and bookbinders. (These groups are described in detail later in this chapter of the Handbook.) Steel and copper plate engravers, who cut or etch lettering and designs into plates by hand or machine, are employed in numerous small engraving shops.

Many other groups of skilled workers are employed in printing plants. Among these are maintenance machinists who are employed in the larger plants to repair and adjust typesetting machines, printing presses, or bindery equipment. There are also about 2,000 to 3,000 machinists who make metal parts or fixtures for printing equipment.

In the skilled occupations, practically all the workers are men. However, many of the less skilled jobs, especially in the binderies, are held

CHART 27



by women. A small but growing number of Negroes are employed in skilled jobs; a greater number are employed in the less skilled occupations. In the several hundred shops which print newspapers, magazines, or other items mainly for the Negro community, the great majority of the workers in all types of jobs are Negroes.

In addition to skilled craftsmen, printing establishments employ a great many persons as executives, estimators, salesmen, accountants, engineers, stenographers, clerks, and laborers of various types. The duties of these employees are similar to those of comparable personnel in other industries, and are discussed elsewhere in this Handbook. (See index.) Newspapers and other publishers employ a considerable number of reporters and editors. These occupations are discussed in another chapter of this Handbook. (See p. 203.)

Training and Other Qualifications

The most common way of entering a skilled printing occupation is through apprenticeship. With rare exceptions, it is the only means by which one may be trained to become a journeyman in a union shop. Formal apprenticeship is also required for journeyman status in many of the larger establishments not covered by union contracts. In some of the smaller shops, however, it is possible to pick up the printing trades by working with printing craftsmen or by a combination of work experience and schooling.

Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and the shop or area practices. The training program covers all phases of the particular trade and almost always includes classroom or correspondence study in related technical subjects in addition to training on the job. To be eligible for apprenticeship, applicants are generally required to be between 18 and 30 years of age. Applicants are generally required to take a physical examination.

In selecting applicants for apprenticeship, most employers require a high school education or its equivalent. A thorough knowledge of spelling, punctuation, and grammar is essential for some of the printing trades. Courses in art, such as drawing, design, color, and lettering, as well as courses in physics and chemistry, are also helpful for many kinds of printing work. About 3,000 vocational or high schools offer courses in printing. These courses may materially help a young person to be selected as an apprentice. Mechanical aptitude is essential for the printing trades. Apprentices are often chosen from among the young men already employed in various unskilled jobs in printing establishments.

Employment Outlook

There will be many opportunities for young men to enter the skilled printing trades in the 1960's. These openings will occur as a result of the expected moderate growth in the employment of skilled printing workers and of the need to replace craftsmen who retire, die, or transfer to other fields of work.

A continued rise in the volume of printing material produced is anticipated because of population growth, the expansion of the American economy, and the trend toward greater use of printed material for packaging, information, advertising, and various industrial and commercial purposes. However, as in the past, employment in the skilled printing trades as a whole is not expected to increase as fast as the total output of printed matter, partly because of developments in technology. Employment in the skilled printing crafts is expected to increase somewhat more slowly than the Nation's total working population—which is expected to expand by about 20 percent in the next decade.

A number of technological advances, mainly in the area of type composition and platemaking, now being introduced in the industry will affect printing methods and the number and skills of printing workers employed. Among these are developments in photocomposing, phototypesetting, electronic printing and engraving, and color scanning. The screen process, which involves skills that differ significantly from those in other printing processes, has been gaining in popularity and competes with lithography in certain kinds of work, especially color display advertising. Research is being expanded in several other areas, particularly those involving electronic or magnetic principles. However, in the past, as new technological developments have been introduced into the industry, they have been incorporated in the duties of the traditional printing crafts and included in the apprenticeship training.

As in the past, there will be differences in the rate of growth among the various printing crafts. A moderate increase is expected in the 1960's in the number of skilled composing room workers, the largest group of printing craftsmen. These occupations are most likely to be affected by changes in printing equipment and competitive printing methods. The number of workers in these occupations in the 1940 to 1958 period increased more slowly than total employment in printing and publishing in the same period. The largest proportionate job increases can be expected among pressmen and lithographic workers. These groups have also shown the greatest growth since World War II, as indicated in the employment outlook for individual printing crafts discussed later in this chapter.

The need to replace workers who retire, die, or transfer to other fields of work will provide many openings for young men in the various printing crafts. Retirements and deaths alone will create about 6,000 to 7,000 job openings each year in the 1960's.

At the beginning of 1958, about 14,000 registered apprentices were training in the skilled printing crafts. (A registered apprentice is an employee who, under an expressed or implied agreement, receives instruction in an apprenticeable occupation for a stipulated term and who is employed in an apprenticeship program registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship.) In addition, there were perhaps 8,000 to 10,000 apprentices in programs which were not registered. Furthermore, a substantial number of persons were picking up a printing trade while working as helpers, particularly in small shops and in small communities.

Opportunities for young men to receive apprenticeship training will be available in all parts of the country. Some indication of the location of future apprenticeship opportunities may be obtained by examining the latest data showing the geographical distribution of registered apprentices. It must be borne in mind, however, that registration is voluntary and that in some localities employers, for one reason or another, have not registered their apprenticeship programs. The following nine States and the

District of Columbia accounted for about 70 percent of the number of registered apprentices in training for selected printing trades, as of January 1, 1958: New York, 2,458; Ohio, 1,384; California, 1,237; Minnesota, 817; Michigan, 734; Pennsylvania, 713; Massachusetts, 642; Connecticut, 628; Wisconsin, 405; and the District of Columbia, 375.

Earnings and Working Conditions

Earnings in the printing and publishing industry are among the highest in manufacturing industries. In April 1959, production workers in this industry (including semiskilled and unskilled workers in addition to printing craftsmen) averaged $101.73 a week or $2.67 an hour. This compares with the average for production workers in all manufacturing industries of $89.87 a week or $2.23 an hour in the same month.

The amount an individual printing craftsman can expect to earn varies from one occupation to another. Generally, the wage rates in large cities are higher than in small communities. Wage rates also differ by type of printing establishment. The best source of information on basic pay rates in the printing trades is the union hourly wage rates for selected occupations in important printing centers reported annually to the U.S. Department of Labor's Bureau of Labor Statistics. The union rates are the minimum basic rates for the individual occupational classifications. They do not include overtime, other special payments, or bonuses. The following tabulation shows the average union minimum hourly wage rates (individual rates are weighted by the number of union employees reported at each rate) for day work for selected printing occupations in 53 cities of 100,000 or more population, on July 1, 1958.

Printing trade	Average minimum hourly rate, July 1958	
	Newspaper	Book and job
Bookbinders	----------	$2.93
Compositors, hand	$3.23	3.17
Electrotypers	----------	3.42
Photoengravers	3.53	3.70
Pressmen (journeymen)	3.19	----------
Pressmen (cylinder)	----------	3.15
Pressmen (platen)	----------	2.83
Stereotypers	3.17	3.45

Table 1 shows these wage rates for each occupation in 32 of these important printing centers.

TABLE 1. *Union scales of wages in the printing trades, selected cities,[1] July 1, 1958*

City	Hand compositors		Pressmen, cylinder and rotary	Pressmen-in-charge	Pressmen, journeymen	Photoengravers		Electrotypers	Stereotypers	Bookbinders
	Book and job	Newspaper	Book and job	Newspaper	Newspaper	Book and job	Newspaper	Book and job	Newspaper	Book and job
Atlanta, Ga	$2.94	$3.05	$2.66–$3.04	$3.30	$3.03	$3.13–$3.29	$3.24	$3.12	$3.03	$2.92
Baltimore, Md	2.88	3.24	2.62– 2.67	3.31	3.11	3.11– 3.44	3.46	2.80	3.10	2.55
Boston, Mass	2.87	3.29	2.74– 3.24	3.42	3.19	3.39	3.44– 3.70	3.20	3.35	2.74
Buffalo, N.Y	3.07	3.28	2.97– 3.35	3.40–3.47	3.20–3.40	3.31	3.56	3.15	3.20	2.85–2.87
Charlotte, N.C	2.36	2.87	----------	3.07	2.80	----------	----------	----------	2.80	----------
Chicago, Ill	3.31	3.55	3.37– 3.87	3.49–3.62	3.31–3.38	4.16– 4.21	3.75	3.60	3.31–3.71	2.94–3.27
Cincinnati, Ohio	3.01	3.16	2.53– 3.28	3.19	3.06	3.32	3.37	3.17	3.11	2.85
Cleveland, Ohio	3.12	3.23	3.16– 3.66	3.46–3.69	3.14–3.57	3.44– 3.89	3.49	3.26	3.17	3.04
Columbus, Ohio	3.07	3.19	3.08	3.49	3.15	3.23– 3.44	3.48	3.25	3.14	3.00
Dayton, Ohio	3.27–3.30	3.05	3.03– 3.47	3.25–3.63	3.05–3.42	3.32	3.24	3.36	3.05	2.74–3.08
Des Moines, Iowa	2.88–3.22	3.16	2.79– 3.49	3.44	3.21	3.34	3.34	3.33	3.14	2.75–3.08
Detroit, Mich	3.32–3.47	3.44	3.27– 3.79	3.44–3.89	3.18–3.46	3.31– 4.13	3.61	3.59	3.36	3.01–3.17
Houston, Tex	3.01	3.09	2.80– 3.00	3.22	3.02	3.33	3.86	3.24	2.99	2.77
Indianapolis, Ind	2.81	3.18	2.86– 3.07	3.44	3.20	3.32	3.32	3.10	3.16	2.78
Jacksonville, Fla	2.50	2.97	2.13	3.23	2.97	2.97	2.97	3.00	2.97	----------
Los Angeles, Calif	3.17–3.32	3.31	3.18– 3.53	3.34	3.14	3.79	3.50	3.51	3.25	3.28
Memphis, Tenn	2.70	3.06	2.58– 2.68	3.25	2.99–3.18	3.14	3.29	----------	2.97	----------
Milwaukee, Wis	3.08	3.25	2.98– 3.18	3.43	3.17–3.30	3.45	3.49	3.35	3.17	2.92
Minneapolis-St. Paul, Minn	3.27–3.29	3.44–3.49	3.27– 3.44	3.36–3.55	3.09–3.30	2.99– 3.91	3.38–3.47	3.47	3.12–3.30	3.15–3.17
Newark, N.J	3.26	3.33	3.29– 3.43	3.55	3.35	3.94– 4.10	----------	3.74	3.28	2.64–3.06
New Haven, Conn	2.77–2.98	2.96	2.56– 3.06	3.16	2.96	3.09	----------	3.18	2.96	2.86
New Orleans, La	2.80	----------	2.80	3.07	2.91	2.83	2.99	3.07	2.93	2.66
New York, N.Y	3.43	3.53	3.28– 3.68	3.68–4.06	3.33–3.75	4.09	3.77	3.74	3.17	1.95–3.17
Oklahoma City, Okla	----------	----------	2.30– 2.55	3.26	2.93–3.06	2.93	3.37	----------	2.99	2.43
Philadelphia, Pa	2.85	3.13	3.00– 3.66	3.33–3.57	3.04–3.37	3.66– 3.87	3.43	3.44	3.05	2.52–2.75
Pittsburgh, Pa	3.24	3.29	3.28– 3.41	3.31	3.04	3.25– 3.54	3.44	3.10	3.05	2.86–3.31
St. Louis, Mo	3.13–3.22	3.42	2.73– 3.35	3.49–3.63	3.23–3.36	3.27	3.52	3.10	3.17	2.89–2.96
Salt Lake City, Utah	2.72	3.10	2.72	3.14	3.01	3.20	3.24	----------	3.00	----------
San Francisco, Calif	3.48	3.12	3.43– 3.48	3.43	3.12	3.57	3.49	3.49	3.23	3.48
Seattle, Wash	3.53	3.56	3.29	4.02	3.45	3.69	3.58	3.81	3.56	3.43
Springfield, Mass	2.40	2.53	2.27	----------	----------	2.96	2.96	3.20	2.53	----------
Washington, D.C	3.12	3.44	2.44– 3.52	3.40	3.19–3.30	3.33	3.66	3.31	3.19	2.83

[1] Data covers only day rates and English language newspapers.

(Wage rates for lithographic workers are shown in table 2 on p. 348.)

A standard workweek of 37½ hours was specified in labor-management contracts covering a majority of the organized printing trades workers, although standard workweeks of 36¼ hours are also fairly common. Work on Sundays and holidays is customarily paid for at time and a half or double-time rates in most printing establishments. In newspaper plants, however, an individual employee's workweek often includes Sundays. Time and a half or double time is paid for these days only when they are not part of the employee's regular shift. Night shift workers generally receive pay differentials above the standard day rates.

The starting wage rates of apprentices generally vary from 40 to 50 percent of the basic rate for journeymen in the shop. Wages are increased periodically, usually every 6 months, until, in the final year or half year of training, the apprentice receives from 80 to 95 percent of the journeyman rate. Apprentices with prior experience, civilian or military, or in exceptional cases, technical school training, can obtain credit which will start them above the beginning apprentice pay rate and also reduce the length of time required to become a journeyman. Apprentices may be upgraded when they show exceptional progress.

The amount printing craftsmen can earn during a year depends not only on the rate of pay, but also on the regularity of employment. The printing industry has fewer seasonal fluctuations than most other manufacturing industries and this is one of the reasons why it offers its workers steadier employment and higher average annual earnings.

Paid vacations are typical in the industry. The most common provision is 2 weeks' vacation with pay after 1 year's employment. Other major benefits, such as paid holidays and programs providing retirement pay, life and disability insurance, hospitalization, and severance pay are also common. In addition, a number of printing trade unions have for many years operated their own programs providing their members with one or more types of benefits, such as life insurance, retirement, sickness, or disability payments.

The accident-frequency rate in the printing industry is lower than the average for all manufacturing industries. In 1957, the injury-frequency rate was 9.2 disabling work injuries per million man-hours worked in printing and publishing compared with the average of 11.4 for all manufacturing industries.

A large proportion of the skilled workers in the industry are members of unions affiliated with the AFL–CIO. The two largest unions are the International Typographical Union and the International Printing Pressmen and Assistants' Union of North America. Other printing craft unions include the International Photo-Engravers' Union of North America, International Stereotypers' and Electrotypers' Union of North America, and International Brotherhood of Bookbinders. Their names indicate the crafts included in their membership. The majority of lithographic workers are in plants under contract with the Amalgamated Lithographers of America (Ind.), a union which organizes on a plant-wide basis, and, therefore, includes skilled craftsmen as well as other lithographic workers.

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Where To Go for More Information

Information on opportunities for apprenticeship or other types of printing employment in a particular locality may be obtained from various sources. Applicants may apply directly to the printing establishments in their areas. The names and locations of local printers can usually be obtained from the classified section of the local telephone directory. In addition, the local unions and employer associations in the printing industry can often provide information regarding apprenticeship openings. In union shops, many apprenticeship programs are supervised by joint union-management committees. In these plants, applicants for apprenticeship may apply directly to the coordinator of the joint apprenticeship committee. In recent years, there has been a trend toward increased use of local offices of the State employment services as contact points for apprenticeship openings. Some local employment service offices provide such services as screening applicants and giving aptitude tests. However, the final selection is made by the employer, the joint apprenticeship committee, or the union.

For general information on the printing industry, applicants may write to the following organizations. (See sections on individual printing occupations for names of labor organizations and trade associations which can provide more information on specific printing trades.)

American Newspaper Publishers Association,
750 Third Ave., New York 17, N.Y.

Book Manufacturers' Institute, Inc.,
25 West 43d St., New York 36, N.Y.

Education Council of the Graphic Arts Industry, Inc.,
5728 Connecticut Ave. NW., Washington 15, D.C.

Printing Industry of America, Inc.,
5728 Connecticut Ave. NW., Washington 15, D.C.

Screen Process Printing Association,
549 West Randolph St., Chicago 6, Ill.

Composing Room Occupations

The printing process begins in the composing room where the manuscript copy is set in type, chiefly by typesetting machines, but also by hand. Machine- and hand-set type, photoengraving "cuts" (printing plates), and other materials necessary to complete printing jobs are then assembled and made ready for the pressroom.

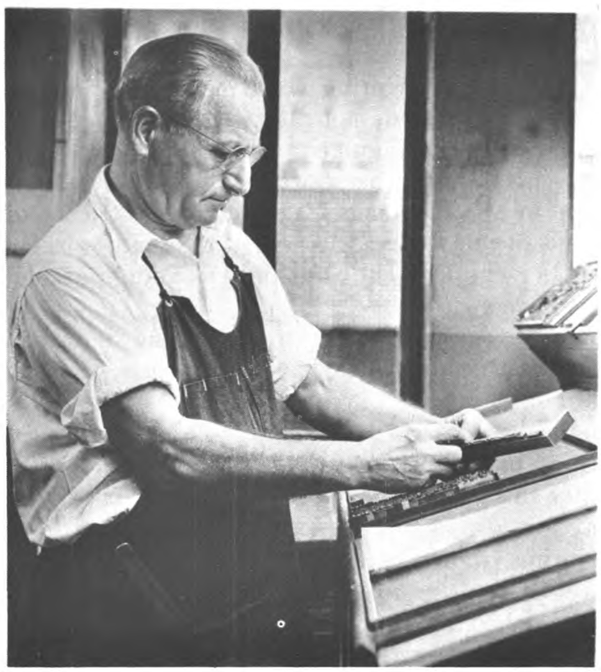
In 1958, about 180,000 skilled workers, more than half of all printing craftsmen, were employed in composing room occupations. These occupations offer good opportunities for young men willing to spend several years in learning a skilled craft. Usually, workers in these occupations have year-round employment and better-than-average earnings. The two principal composing room occupations are those of hand compositor and typesetting machine operator. Others include Monotype keyboard operator, Monotype caster operator, Teletypesetter operator, and proofreader. A new group of composing room occupations, usually made up of "photocompositors" is becoming important, particularly in commercial printing establishments and trade composition shops, which do type composition for printing firms, advertising departments of large business firms, and advertising agencies.

Skilled composing room workers are employed in newspaper plants, commercial printing shops, and periodical and book printing establishments, as well as trade shops. They work throughout the country, in almost every community. Employment, however, is concentrated in larger commercial and industrial cities, such as New York, Chicago, Philadelphia, Los Angeles, Boston, Washington, D.C., San Francisco, Detroit, St. Louis, Baltimore, and Cleveland.

Nature of Work

Hand Compositors (*typesetters*) (D.O.T. 4-44.010) make up the oldest and largest composing room occupation. In 1958, about 82,000 skilled workers were employed in this trade.

An important function of workers in this occupation is to set type by hand for the printing of advertisements and other small jobs that are impractical to set by machine. In setting type by hand, the hand compositor, reading from the manuscript copy, sets each line of type in a "composing stick" (a device which holds type in place) letter by letter and line by line. When this stick is full, he slides the completed lines onto a shal-



Hand compositor setting type in a composing stick.

low metal tray called a "galley." The next step is the major function of the hand compositor—to assemble all the materials necessary to complete the job by arranging machine- and hand-set type and any needed engravings into pages. He then locks the completed pages into forms before sending them to the pressroom or the platemaking departments. After final printing on the presses, the hand compositor also breaks down the type forms and distributes the foundry type to the proper storage compartments for reuse. In large plants, such workers may specialize in a particular operation, such as "page makeup."

Typesetting Machine Operators (D.O.T. 4-44.110) (Linotype or Intertype) make up the second largest composing room occupation. More than 75,000 workers were employed in this craft in 1958. These craftsmen operate semiautomatic machines which set the type much more rapidly than the hand compositors. Nearly all newspaper plants or large commercial shops which need large amounts of type composition use these machines and operators to set type.

In setting type, the operator, reading from copy clipped to the machine's copy board, selects the letters and other characters by operating a keyboard (somewhat similar to that on a typewriter) which has 90 keys. As he presses the keys, the letters, in forms of metal molds or "matrices," are assembled into words and lines. After he completes each line, the operator works a lever and the machine automatically casts the line of type into a solid strip of metal called a "slug." The slugs are then deposited in a galley and are later assembled into type forms from which either the printing impressions or plates are made. In the smaller plants, the typesetting machine operator maintains and repairs as well as operates the typesetting machines. In the larger shops, maintenance machinists are employed to make all but minor adjustments to the machines.

Monotype keyboard operators (D.O.T. 4-44.120) operate a machine which has a keyboard somewhat similar to that on a typewriter, but which includes about four times as many keys. Unlike the typesetting machine, which does the entire typesetting job, the Monotype keyboard produces only a perforated paper roll. This roll is later fed into a Monotype casting machine which casts and assembles type automatically. (See the following description of Monotype caster operator.) In contrast to the typesetting machine, the Monotype makes possible the automatic casting of individual letters and other characters. This permits corrections to be made by hand without the need of resetting the entire line. Monotype thus retains some of the flexibility of hand composition while offering the speed of machine operation. About 10,000 of these workers were employed in 1958.

COURTESY OF U.S. GOVERNMENT PRINTING OFFICE

Typesetting machine operator at keyboard.

Monotype Caster Operators (D.O.T. 6-49.310) operate the Monotype casting machines referred to above. These machines cast and assemble type automatically, guided by the perforations in the rolls of the paper prepared by the Monotype keyboard operator. New type is made for every job. The roll of paper is fed into the Monotype casting machines and the proper matrices (molds) for casting the letters are automatically selected by means of the perforations on the tape. Molten type metal is forced into the matrix to form the individual letters. The principal duties of these workers are to set up the machine, tend it while it is operating, and do necessary maintenance and repair work. Only one caster operator is employed to every two or three keyboard operators. Composition service shops are the largest employers of both Monotype keyboard and caster operators.

Training and Other Qualifications

Apprenticeship is the principal way to become a compositor, especially in union shops. Many compositors, however, have acquired their skills while working as helpers for several years (particularly in small shops and in the smaller communities) or through a combination of trade school and helper experience.

Generally, apprenticeship training for compositors covers a 6-year period of progressively advanced training, supplemented by classroom instruction or correspondence courses. However, this period may be shortened by as much as 2 years for apprentices who have had previous experience or schooling or who have shown the ability to learn the trade more rapidly. The time and emphasis spent upon any particular phase of training varies from plant to plant, depending upon the type of printing establishment.

A typical apprenticeship program for compositors includes elementary hand composition and page makeup, lockup, and lineup. After basic training as a hand compositor, the apprentice receives intensive training in one or more specialized fields, such as the operation of Monotype, Linotype, Intertype, and phototypesetting and teletypesetting machines, as well as specialized work in hand composition and photocomposition.

To be eligible for apprenticeship, an applicant generally must be in good physical condition, at least 16 years old, and a high school graduate. Applicants are sometimes given aptitude tests. Important qualifications include training in English and mathematics. Imagination and artistic ability are also assets which may be helpful to a compositor in layout work. Printing courses in vocational or high schools are good preparation for apprentices.

Apprentices are paid according to a predetermined wage scale, which increases as the apprenticeship period advances. At the beginning of 1958, there were 6,000 registered apprentices in training for skilled composing room jobs.

Employment Outlook

There will be many opportunities for young men to enter the skilled composing room occupations during the 1960's. Because composing room jobs make up a very large occupational field (about 180,000 skilled workers in 1958), just to replace those skilled workers who retire or die will create about 3,000 to 4,000 job openings each year.

The anticipated expansion in the volume of printing in the United States during the next decade is expected to result in only a small rise in employment for this group. This was also true in the period between 1940 and 1958 when employment in the composing room crafts increased much more slowly than the volume of printing produced and the growth of total employment in the printing industry.

Changing technology will tend to limit the growth of this occupation. Some developments now being introduced will significantly affect the skill requirements of compositors as well as the number of workers required. One such development is the greater use of photocomposition machines that set material formerly set by typesetting machine and hand. Photocomposition requires care in planning and layout. Another machine permits automatic typesetting by remote control. A punched tape run at a central point can operate typesetting machines in any number of locations. If widely adopted, these machines could reduce the number of jobs for typesetting machine operators in newspaper plants or large commercial printing establishments. The apprenticeship training programs for composing room craftsmen include instruction in the operation of these new machines and related processes, and thus these skills have become part of the present crafts.

Earnings and Working Conditions

As is true for most printing crafts, wages of skilled composing room workers are relatively high compared with skilled workers generally. However, there is considerable variation in wage rates from place to place and from firm to firm.

According to the Bureau of Labor Statistics' survey of union wages in the printing trades, the average union minimum hourly wage rate for hand compositors in 53 cities of 100,000 or more population was $3.23 in newspaper plants and $3.17 in book and job shops on July 1, 1958. Union minimum wage rates for hand compositors ranged from $2.36 an hour in book and job shops in Charlotte, N.C., to $3.56 an hour in newspaper plants in Seattle. Union minimum hourly wage rates in effect on July 1, 1958, for 32 selected cities are shown in table 1 on page 336.

Working conditions for compositors vary from plant to plant. Some heat and a great deal of noise are made by typesetting machines. In general, the newer plants are well lighted and clean, and many are air conditioned. Composing room jobs do not require exceptional physical strength, but hand composing work does require standing for long periods of time. Young men with some types of physical handicaps, such as deafness, have been able to enter the trade and do the work satisfactorily. There is considerable nightwork for compositors. Employees generally receive additional pay for working the second or third shift.

A substantial proportion of compositors are members of the International Typographical Union.

Where To Go for More Information

International Typographical Union,
2820 North Meridian St., Indianapolis 6, Ind.

See page 337 for additional sources of information.

Photoengravers

(D.O.T. 4–47.100 and .200)

Nature of Work

The photoengraver makes metal printing plates of illustrations and other copy that cannot be set up in type. On these plates the printing surfaces stand out in relief above the nonprinting spaces, as do the letters and the accompanying type. Similarly, gravure photoengravers, a specialized type of photoengraver, make plates for use in reproducing pictures and type, but these are gravure plates with the image etched below the surface.

In making a photoengraving plate for the letterpress process, the entire job may be done either by one man or by a number of skilled workers, each specializing in a particular operation. These specialized workers are cameramen, printers, etchers, finishers, routers, blockers, and provers. In the large shops, the work is almost always divided among a number of these specialists.

A *cameraman* starts the process of making a photoengraving plate by photographing the material to be reproduced through a cross-lined screen, which breaks down the copy into thousands of tiny dots. After the cameraman develops the negative, the *printer* prints the image on a metal plate by coating the plate with a solution sensitive to light and then exposing it and the negative to arc lights. The image areas are protected by chemical means so that when the plate is placed in an acid bath by the *etcher*, only the nonimage areas are etched away, leaving the image areas standing out in relief.

Photoengraver cutting away metal from nonprinting areas of a plate.

A number of other photoengraving operations are then performed. The *finisher* carefully inspects and touches up the plate with handtools; the *router* cuts away metal from the nonprinting part of the plate to prevent it from touching the inking rollers during printing; the *blocker* mounts the engraving on a suitable base to make it reach the right height; and the *prover* prints a sample copy on a proof press.

The operations involved in gravure photoengraving are much like those in letterpress photoengraving except that a positive instead of a negative is used in making the plate, and the image areas, rather than the background, are etched away.

Where Employed

About 17,000 journeymen photoengravers were employed in 1958. The great majority of photoengravers (about 12,000) are employed in commercial service shops where the main business is making photoengravings for use by others. Newspaper and rotogravure shops employ about 5,000 photoengravers, nearly a third of all journeymen. In addition, book and periodical shops and the United States Government Printing Office also employ a number of photoengravers. Many craftsmen have their own shops. Photoengravers' jobs are highly concentrated in the largest printing centers, particularly New York, Chicago, Philadelphia, and Los Angeles.

Gravure photoengravers work mainly in independent gravure plants. Most of them work for the small number of big firms which handle a large proportion of all gravure work. A few large newspaper and commercial plants also have departments where this work is done. Gravure plants are concentrated in a few States, particularly New York, New Jersey, Illinois, and Ohio.

Training and Other Qualifications

Apprenticeship is the accepted way to become a photoengraver. The apprenticeship program generally covers a 5- or 6-year period and includes at least 800 hours of related classroom instruction. Besides the care and use of tools, the apprentice is taught to cut and square negatives, make combination plates, inspect negatives for defects, mix chemicals, sensitize metal, and to operate machines used in the photoengraving process.

To be eligible for apprenticeship training, an applicant must be at least 18 years of age and generally must have a high school education or its equivalent. If possible, this education should include courses in chemistry and physics and training in art. Credit for previous experience acquired in photoengraving work may shorten the required apprenticeship time. Many employers require a physical examination for prospective photoengravers; the condition of the applicant's eyes is particularly important because a photoengraver's duties involve constant close work and color discrimination.

Employment Outlook

The anticipated continued expansion in printing output, the greater use of photographs and other illustrations, and the increasing use of color are expected to result in a small increase in the number of photoengravers during the 1960's. Technological changes, such as wider use of phototypesetting and more rapid etching techniques, may result in more work for photoengravers, but the introduction of photographically and electrically made plates may limit the growth of employment of these workers. This is a small occupation with about 17,000 workers. On the average, the growth in employment and replacement needs together probably will result in 500 to 800 openings for new workers each year in the next decade.

Earnings and Working Conditions

Photoengravers are among the highest paid printing craftsmen. According to the Bureau of Labor Statistics' survey of union wages in the printing trades, the union minimum hourly wage rate for photoengravers, including gravure, in book and job shops, in 53 cities of 100,000 or more population ranged from $2.83 in New Orleans to $4.21 in Chicago on July 1, 1958. The union hourly wage rates for photoengravers in effect on July 1, 1958, for 32 selected cities, are shown in table 1 on page 336.

The great majority of photoengravers are union members. Nearly all photoengravers are represented by the International Photo-Engravers' Union of North America.

Where To Go for More Information

American Photoengravers Association,
166 West Van Buren St., Chicago 4, Ill.

International Photo-Engravers' Union of North America,
3605 Potomac St., St. Louis 16, Mo.

See page 337 for additional sources of information.

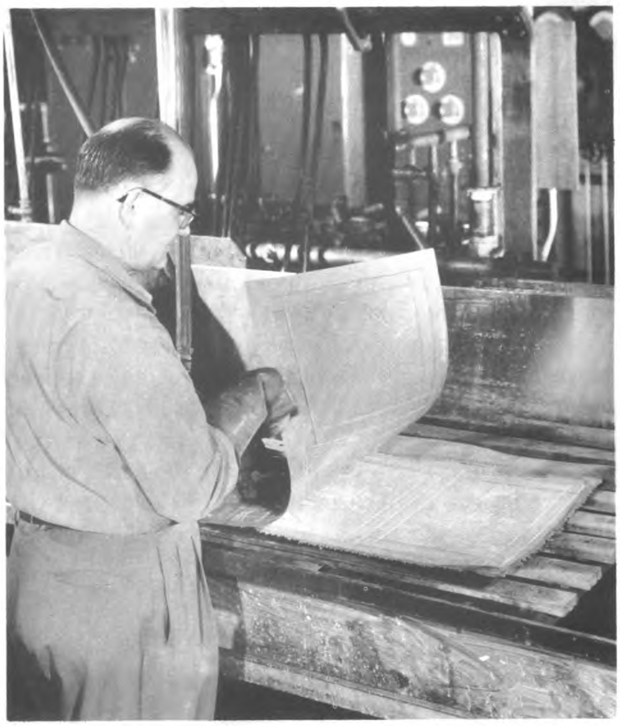
Electrotypers and Stereotypers

Nature of Work

Electrotypers (D.O.T. 4–45.010) and *stereotypers* (D.O.T. 4–45.210) make duplicate metal, plastic, and rubber press plates for letterpress printing from the metal type form prepared in the composing room. (The production of plastic or metal plates is a recent development in platemaking.) Electrotypes are used mainly in book and magazine work; stereotypes, which are less durable, in newspaper work. Electrotyping and stereotyping are necessary because most volume printing requires the use of duplicate printing plates. When a large edition of a book or magazine is printed, several plates must be used to replace those which have become too worn to make clear impressions. By means of duplicate plates, printers can also use several presses on the same job, at the same time, and thus finish a big run quickly. This is especially important in publishing daily newspapers. Furthermore, the rotary presses used in many big plants require curved plates which can be made by both electrotyping and stereotyping processes from the flat type forms.

Several steps are required to produce a fine metal plate ready for use in the pressroom. In electrotyping, the first step is making a wax or plastic mold of the type form, coating it with special chemical solutions, and then suspending it in an electrolytic solution containing metal. This leaves a metallic shell on the coated mold, which is then stripped from the mold, backed with metal, and carefully finished.

The stereotyping process is much simpler, quicker, and less expensive than electrotyping, but it does not yield as durable or as fine a plate. Stereotypers make molds or mats of papier maché (a strong material composed of paper pulp) instead of wax or plastic. This involves placing the moist mat (in newspaper printing, usually a dry mat) on the type form, and covering it with a cork blanket and sheet of fiberboard. The covered form is then run under heavy power-driven steel rolls to impress the type and photoengraving on the mat. After the paper mold has been dried, it is placed in a stereotype casting machine which casts a composition lead plate on the mold. In the larger plants, stereotype plates are usually cast automatically in a machine known as an autoplate.



Electrotyper removing completed shell from a mold.

In many of the larger plants, electrotypers and stereotypers perform only one phase of the work, such as wax casting, molding, finishing, or blocking. However, journeymen must know how to handle all the tasks involved in their respective process.

Electrotypers and stereotypers are often employed in independent service shops which do this type of work for printing firms. Many electrotypers also work in large book and periodical plants. Stereotypers generally work in newspaper plants, but many are employed in large commercial printing plants.

Training and Other Qualifications

Nearly all electrotypers and stereotypers have learned their trades through apprenticeship. Electrotyping and stereotyping are separate crafts, and there is little transferability between the two. The apprenticeship training program in each trade covers all phases of each trade and almost always includes classes in related technical subjects as well as training on the job. Apprenticeship training for electrotypers and stereotypers usually covers a 5- or 6-year period of reasonably continuous employment.

Applicants for apprenticeship must be at least 18 years of age and, in most instances, must have a high school education or its equivalent. If possible, this education should include mechanical training and courses in chemistry. Physical examinations and aptitude tests are often given to prospective apprentices. The emphasis placed upon different phases of training varies from plant to plant, however, depending upon the type of printing establishment.

During the apprenticeship for stereotypers, trainees are taught matrix molding, flat casting, color register, curved routing, and the use of casting machines. Because electrotypers specialize in one or more of the various aspects of the trade, the apprenticeship programs generally tend to be specialized for such specific jobs as molding and finishing.

Employment Outlook

Employment of electrotypers and stereotypers is expected to increase somewhat during the 1960's. The anticipated growth in the total volume of printing, particularly the increased amount of printing required for paper box containers, should result in a substantial increase in the demand for electrotyping and stereotyping. However, technological advances, such as the increased use of automatic plate composition, which eliminates many of the steps in the processes, and the increased use of nonmetallic plates, such as rubber, in commercial printing, may limit somewhat the employment growth in these crafts.

Replacement needs will also provide some job opportunities for new workers in these crafts. However, these are relatively small occupational fields, employing about 13,000 journeymen in 1958. Growth in these occupations combined with replacement needs will result in several hundred job openings annually in the 1960's.

Earnings and Working Conditions

On July 1, 1958, the union minimum hourly wage rate for electrotypers and stereotypers in both newspaper and book and job plants in 53 cities of 100,000 or more population averaged $3.30 or more an hour. Union minimum hourly wage rates for electrotypers in book and job plants ranged from $2.80 an hour in Baltimore to $3.81 an hour in Seattle. In newspaper plants, rates for stereotypers ranged from $2.53 an hour in Springfield, Mass., to $3.71 an hour in Chicago. Union minimum hourly wage rates for electrotypers and stereotypers as of July 1, 1958, in 32 important printing centers are shown in table 1 on page 336.

Much of the work does not require great physical effort since the preparation of duplicate printing plates is highly mechanized. However, there is some lifting of relatively heavy, hot press plates.

Nearly all electrotypers and stereotypers are members of the International Stereotypers' and Electrotypers' Union of North America.

Where To Go for More Information

International Stereotypers' and Electrotypers' Union of North America,
752 Old South Building, Boston 8, Mass.

International Association of Electrotypers and Stereotypers, Inc.,
758 Leader Building, Cleveland 14, Ohio.

See page 337 for additional sources of information.

Printing Pressmen and Assistants

(D.O.T. 4–48.010, .020, 0.30, and 0.60; 6–49.410; 420, .430)

Nature of Work

The actual printing operation is performed in the pressroom. After the type forms from the composing room, the press plates from the electrotyping and stereotyping department, and the gravure and lithographic plates have been brought together, they are made ready for final printing by the printing pressmen. The pressmen's basic duties are to "makeready" and then tend the presses while they are in operation.

The object of the "makeready," which is one of the most delicate and difficult parts of the pressman's work, is to insure printing impressions that are distinct and uniform. This is accomplished by such means as placing pieces of paper of exactly the right thickness underneath low areas of the press plates to level them, and by attaching pieces of tissue paper to the surface of the cylinder or flat platen which makes the impression. Pressmen also have to make many other adjustments—for example, those needed to control margins and the flow of ink to the inking roller. In some shops, they are responsible not only for tending the presses, but also for oiling and cleaning them and making some minor repairs. On the larger presses, they have assistants and helpers.

Pressman checking fidelity of press impressions—an important phase of "makeready" operations.

Pressmen's work may vary greatly among shops, mainly because of differences in the kinds and sizes of presses used. Small commercial shops generally have small and relatively simple platen (or job) presses that are often fed paper by hand. At the other extreme are the tremendous web-rotary presses used by the big newspaper and magazine printing plants. These giant presses are fed paper in big rolls. They print the paper on both sides by means of a series of cylinders, cut the pages, assemble and fold them and, finally, count the finished newspaper sections which emerge from the press ready for the mailing room. These steps are accomplished automatically by means of many different mechanisms, each of which calls for constant attention while a run is being made. Presses of this kind are operated by crews of journeymen and less skilled workers under the direction of a pressman-in-charge. Although the basic duties of the lithographic (offset) pressmen are similar to those of the letterpress and gravure pressmen, there are a number of differences which arise principally from the specialized character of lithographic presses. (See p. 347 for further details.)

The duties of press assistants range from feeding sheets of paper into hand-fed presses to helping pressmen make ready and operate large and complicated rotary presses. Workers whose main responsibility is feeding are often referred to simply as feeders. The ratio of assistants to pressmen varies greatly from one establishment to another, depending on the size of the plant, the type of press used, and other factors. Many shops are too small to have any pressroom assistants.

Training and Other Qualifications

As in the case of the other printing crafts, by far the most common way of learning the pressman's trade is through apprenticeship. Some workers have been able to pick up the trade while working as helpers or press assistants or through a combination of work experience in the pressroom and vocational or technical school training.

The length of apprenticeship and the content of training depend largely on the kind of press used in the plant. The apprenticeship period ranges from 2 to 4 years. The apprenticeship period for pressmen operating large presses is almost always 4 years in union shops. On-the-job training includes the care of pressroom equipment, makeready, running the job, press tending and maintenance, and working with various types of inks and papers. In addition to on-the-job instruction, the apprenticeship training involves related classroom or correspondence school work. At the beginning of 1958, there were about 3,600 registered apprentices in training and perhaps 2,000 others in training in unregistered programs.

Individual companies generally choose apprentices from among press assistants and others already employed in the plant. Young men may often work for 2 or 3 years in the pressroom before they are selected to begin 2- to 4-year training periods leading to journeyman status. A high school education or its equivalent is generally required. Art courses are also very helpful because the increased use of color presses and the need for pressmen who are able to mix their own inks have made a knowledge of color important. Physical strength and endurance are necessary for work on some kinds of presses, where the pressmen have to lift heavy type forms and press plates and stand for long periods. Mechanical aptitude is important in making press adjustments and repairs.

Employment Outlook

The need for pressmen is expected to increase considerably in the next 10 years because of the anticipated rise in the volume of printing and the increased use of color, although continued improvement in the speed and efficiency of printing presses may slow somewhat the rate of expansion of this skilled craft.

The need to replace workers who retire, die, or transfer to other fields of work will also result in job opportunities for new workers. Retirements and deaths alone will create about 1,000 job openings each year in the 1960's.

Earnings and Working Conditions

The earnings of pressmen depend upon the kind of press operated, the type of printing plant, and the geographical area of employment. The Bureau of Labor Statistics' survey of union minimum hourly wage rates in 53 cities of 100,000 or more population shows that the average minimum hourly rate in effect on July 1, 1958, for newspaper pressmen-in-charge was $3.50; for newspaper pressmen (journeymen), $3.19; for book and job cylinder pressmen, $3.15; for book and job platen pressmen, $2.83; and for book and job press assistants and feeders, $2.56. The union minimum hourly wage rates for selected pressmen occupations in 32 important printing centers on July 1, 1958, are shown in table 1 on page 336.

Pressrooms are unavoidably noisy; also, there are the usual occupational hazards associated with machinery. Pressmen often have to lift heavy type forms and printing press plates. At times, they work under pressure to meet deadlines, especially in the printing of newspapers and magazines. Many pressmen work night shifts for which they receive extra pay.

A majority of pressroom workers are covered by union agreements. Practically all of the organized letterpress and gravure pressmen are members of the International Printing Pressmen and Assistants' Union of North America.

Where To Go for More Information

International Printing Pressmen and Assistants' Union of North America,
Pressmen's Home, Tenn.

See page 337 for additional sources of information.

Lithographic Occupations

Nature of Work

Lithography, though still much less common than letterpress work, is one of the most rapidly growing printing processes. Practically all items printed by the letterpress process are also produced by lithography—including books, calendars, maps, posters, labels, office forms, sheet music, and even newspapers. Lithography has special advantages when the copy to be reproduced includes photographs, drawings, or paintings, since it permits greater flexibility in the type of paper that can be used.

In lithography (or offset printing), the press plate is smooth or nearly so, with both the image and nonimage areas on the same level, instead of on different levels as in letterpress and gravure work. Lithography makes use of the principle that grease and water repel each other. The image areas of the plate are coated with a greasy substance to which the greasy printing ink will adhere. On the press, before each inking, the plate is moistened with water, with the result that only the image areas take up the greasy ink from the inking roller. In present day lithographic work, the plates are usually made by a photographic process, and the method is often referred to as photolithography.

There are a number of processes involved in lithography, and each is performed by a specialized group of workers. The main groups of lithographic workers are cameramen, artists and letterers, strippers, platemakers, and pressmen.

Lithographic artist sharpening image on a negative.

The *cameraman* (D.O.T. 4–46.200), begins the lithographic process by photographing the copy. The cameraman nearly always specializes in either black and white or color photography.

After the negatives have been made, they frequently need retouching, to lighten or darken certain parts. Thus, it is often necessary for a *lithographic artist* (D.O.T. 4–46.700) to make corrections by sharpening or reshaping images on the negatives. Highly skilled workers perform this work by hand using chemicals, dyes, and special tools.

To qualify as journeymen, these artists must be adept in one or more of the various retouching methods or in hand drawing with lithographic crayon. Like cameramen, they are customarily assigned to only one phase of the work and may then be known, for example, as dot etchers, retouchers, crayon artists, or letterers, depending on their particular job.

In photolithography, negatives or positives (made by cameramen and corrected by artists) are transferred to press plates by employees in the platemaking department. This can be done by either hand or machine methods. When hand methods are used, the *platemaker* (D.O.T. 4–46.300) covers the surface of the grained metal plate with a coating of photosensitive chemicals, and exposes the plate along with photographic negatives or positives to strong arc lights. The image is thereby formed on the plate from the negative or positive. In the machine process, the platemakers expose the prepared plate and the photograph in a vacuum printing frame or photocomposing machine. The plate is then developed and chemically treated to bring out the image.

The *lithographic pressman* (D.O.T. 4–48.070) "makesready" and tends the lithographic printing presses. He installs the plate on the press, adjusts the pressure for proper printing, cares for and adjusts the rubber blanket which transfers the impression from the plate to the paper, adjusts water and ink rollers for correct operation, mixes inks, and operates the presses. Basically, the duties of these workers are similar to those of letterpress and gravure pressmen. A number of differences arise, however, from the specialized nature of lithographic presses. In large plants, press feeders and helpers are employed whose duties are also similar to those of letterpress and gravure pressmen. (See p. 345.)

Training and Other Qualifications

A 4- or 5-year apprenticeship covering the basic technique of the lithographic process is usually required in order to become an all-round lithographic craftsman. Training emphasis is on the specific occupation in which journeyman status is being sought, although generally, an attempt is made in the training program to make the apprentice familiar with every lithographic operation.

Generally, an applicant for apprenticeship must be in good physical condition, a high school graduate, and at least 18 years of age. Appropriate aptitude tests are usually given to prospective apprentices. Vocational school training and training in photography or art are helpful in learning these crafts.

Employment Outlook

A continued rise in the number of lithographic workers is expected during the 1960's. Offset printing has expanded considerably since World War II, particularly in the commercial printing field where a large number of letterpress concerns have been establishing offset printing departments. In 1958, an estimated 45,000 to 50,000 journeymen lithographic workers were employed. Offset printing should have continued rapid growth because of the greater use of photographs, drawings, and illustrations in printed matter, and because of the more widespread use of color in many printed products. However, new technological developments in the letterpress printing field, particularly in the platemaking and press departments, may slow somewhat the anticipated increase in lithographic employment.

In addition to employment opportunities that will result from the expected growth of offset printing, the need to replace workers who retire, die, or transfer to other fields of work will also provide some job openings. Growth and replacement needs together are expected to provide about 1,500 to 2,000 job opportunities for new workers, on the average, each year during the 1960's.

Earnings and Working Conditions

Table 2, which is based on information from the National Association of Photo-Lithographers, gives union minimum hourly wage rates in 26 selected cities for individual lithographic occupations, as of November 1958.

TABLE 2. *Union minimum hourly wage rates for six lithographic occupations, selected cities, November 1958*

City	Dot etcher or process artist	Letterer	Cameraman	Photocomposition-machine operator	Vacuum frame platemaker	Pressman
Atlanta	$3.17		$3.04		$3.04	$2.87-$3.17
Baltimore			3.18	$3.18	3.11	2.33- 3.26
Boston	3.73	$3.24	3.13-3.47		3.13	2.59- 4.88
Buffalo	3.65	3.23	3.23	3.38	3.15	2.34- 3.84
Chicago	3.71	3.39	3.15-3.55	3.55	3.18	3.28- 4.41
Cincinnati	3.57	3.32	3.15-3.43	3.32	3.32	3.15- 4.28
Cleveland	3.63		3.02-3.20	3.20	3.20	3.02- 4.10
Columbus	3.51		3.17	3.26	3.26	2.71- 3.56
Dayton		2.97	3.05	3.05	2.87	2.60- 3.46
Denver	3.21		2.70-3.08	3.08	3.08	2.17- 3.45
Des Moines	3.22	3.03	3.23		3.03	2.82- 3.37
Detroit	3.41		2.89-3.16	3.29	3.16	2.83- 4.09
Houston	3.35	2.85	2.91		2.91	2.28- 3.35
Indianapolis	3.43	3.20	3.20-3.31	3.31	3.09	3.09- 3.60
Kansas City	3.56		2.99-3.34	3.33	3.33	2.76- 4.16
Los Angeles	3.66	3.52	3.60	3.52	3.52	3.02- 4.23
Milwaukee	3.54	3.36	2.97-3.43	3.36	3.17	2.46- 4.22
Minneapolis-St. Paul	3.55	3.16	3.37	3.37	3.24	2.60- 4.32
New York	3.84	3.63	3.53	3.63	3.63	2.54- 4.48
Oklahoma City	3.14	2.66	2.73		2.73	2.18- 3.03
Philadelphia	3.85	3.49	3.08-3.67	3.49	3.24	2.94- 4.34
Pittsburgh	3.80	3.61	3.19-3.61	3.43	3.43	3.11- 3.98
San Francisco	3.87	3.73	3.81	3.73	3.73	3.23- 4.61
Seattle	3.41		3.41	3.41	3.41	2.78- 3.77
St. Louis	3.61		2.85-3.25		3.25	2.54- 4.50
Washington, D.C	3.78		2.73-3.20	3.27	3.02	2.28- 4.18

SOURCE: National Association of Photolithographers.

In these cities, wage rates for artists and letterers ranged between $2.66 and $3.87 an hour. Rates for cameramen are generally below those of skilled artists but in many plants, the top-grade cameramen earn as much as the highly skilled artists. Workers who do multicolor work are generally higher paid than those who do black and white work only. The wage rates shown for platemakers and related workers include those for men with varying degrees of skill and responsibility. The wide range of wage rates shown for pressmen is due to the many different types and sizes of presses operated.

Many lithographic plants are modern, air-conditioned, and well lighted. Much of the work requires little physical effort since it involves the handling of lightweight materials.

A substantial proportion of lithographic workers are members of the Amalgamated Lithographers of America (Ind.). A considerable number of offset pressmen and other offset workers belong to the International Printing Pressmen and Assistants' Union of North America.

Where To Go for More Information

Amalgamated Lithographers of America (Ind.),
143 West 51st St., New York 19, N.Y.

International Printing Pressmen & Assistants' Union of North America,
Pressmen's Home, Tenn.

Lithographers and Printers National Association,
1025 Connecticut Ave. NW., Washington 6, D.C.

Lithographic Technical Foundation, Inc.,
131 East 39th St., New York 16, N.Y.

National Association of Photo-Lithographers,
317 West 45th St., New York 36, N.Y.

See page 337 for additional sources of information.

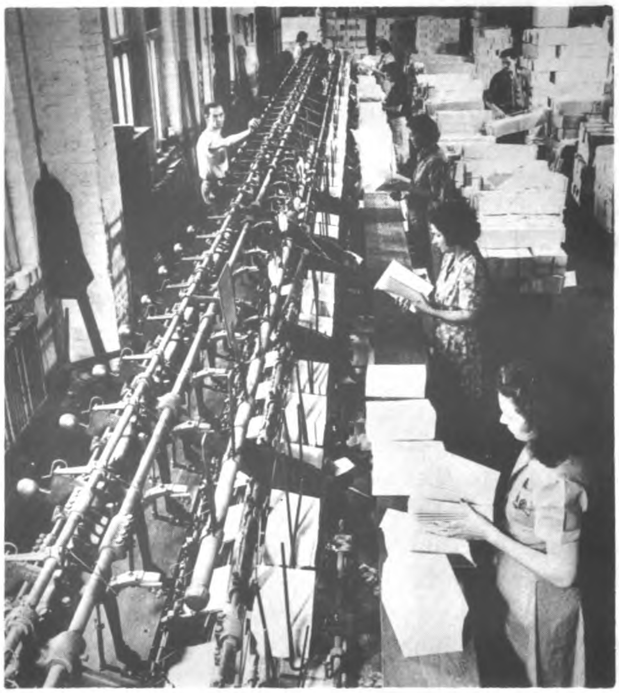
Bookbinders and Related Workers

Nature of Work

Many printed items such as books, magazines, pamphlets, and small calendars must be sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled *bookbinders* (D.O.T. 4–49.010 through .040) who numbered about 20,000 in 1958. Many bookbinders are employed in shops whose chief business is bookbinding. However, a considerable number are employed in the bindery departments of large book, periodical, and commercial printing plants or large libraries.

There are several different kinds of binderies. Edition and pamphlet binderies bind books, magazines, and pamphlets printed in large quantities. Trade or job binderies do bindery work on contract for printers, publishers, or other customers. Blank book and looseleaf binders bind ledgers and bookkeeping and accounting volumes.

Edition binding—making books in quantity from big, flat printed sheets of paper—is by far the most complicated kind of bindery work. The first step in the process is to fold the printed sheets into sections of 16 or 32 pages, known as "signatures," so that the sheets will be in the right order. The next steps are to insert any illustrations that have been printed separately, to gather and assemble the signatures in proper order, and to sew them together. The resulting book bodies are shaped with power presses and



Bindery workers assembling material on gathering machine.

trimming machines, and fabric strips are glued to the backs for reinforcement. Covers are glued or pasted onto the book bodies, after which the books undergo a variety of finishing operations and, frequently, are wrapped in paper jackets. Machines are used extensively throughout the process.

Skilled bookbinders seldom perform all the different edition bindery tasks, although many journeymen have had training in all of them. In large shops, skilled bookbinders are likely to be assigned to one or a few operations, most often to the operation of complicated machines.

In many binderies, especially large ones, much of the work is done by employees trained in only one operation or in a small number of relatively simple, related tasks. These workers, often classified as bindery workers or bindery hands, are mostly women (hence the common designation, bindery women). Their work closely resembles assembly line factory work. About 40,000 women and men were employed in these operations in 1958.

Training and Other Qualifications

A 4- or 5-year apprenticeship which includes on-the-job training as well as related classroom instruction is generally required to qualify as a skilled bookbinder. Apprenticeship programs may vary considerably among the various types of bookbinding shops. Where large quantities of books are bound on a mass production (edition) basis, emphasis is on the most modern machine methods. Where fine hand binding is done, the training is mainly in hand methods, including artistic designing and decorating of leather covers. For many years, hand bookbinding has been declining in importance.

To be eligible for apprenticeship, the applicant usually must have a high school education and be at least 18 years of age. Mechanical aptitude is helpful to the person entering this trade. In the course of the apprenticeship, trainees learn, among other things, to assemble signatures, renovate old, worn bindings, and use various binding machines like punches, folders, perforators, stitchers, and power cutters.

For the less skilled bindery occupations, the training period may last from several months to 2 years. In union shops, apprenticeship programs for women bindery workers generally last 2 years. These formal programs include classroom instruction as well as on-the-job training.

Employment Outlook

Little increase in the number of jobs for skilled bookbinders is expected during the 1960's. Replacement needs, however, will result in several hundred job opportunities each year for new workers to learn the skilled bookbinding trade. There will be considerably more openings for the less skilled bindery workers.

The anticipated expansion of bound printing matter is not expected to result in any significant increase in employment for the skilled bookbinder. Continued mechanization of bookbinding operations and the declining demand for fine hand bookbinding will limit the growth of this trade. On the other hand, these same trends should result in increased employment for the less skilled bindery workers, most of whom are women. Because there is considerable turnover among these employees, there will be a relatively large number of openings for women workers. Seasonal fluctuations in employment are more common in bindery work than in other printing occupations.

Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average of other printing crafts. The Bureau of Labor Statistics' survey of union minimum hourly wage rates conducted in 53 cities of 100,000 or more population showed, as of July 1, 1958, that the minimum hourly wage rate for bookbinders in book and job establishments was generally more than $2.60 an hour and as high as $3.48 in the San Francisco-Oakland area. The wage rates for bindery women are considerably lower and are among the lowest for printing industry workers. They ranged from $1.29 an hour in New Orleans to $2.15 in the San Francisco–Oakland Area. The union hourly wage rate for skilled bookbinders in 32 important printing cities on July 1, 1958, are shown in table 1 on page 336.

A majority of bindery workers are members of unions. Most skilled bookbinders are represented by the International Brotherhood of Bookbinders.

Where To Go for More Information

International Brotherhood of Bookbinders,
815 16th St. NW., Washington, D.C.

See page 337 for additional sources of information.

MECHANICS AND REPAIRMEN

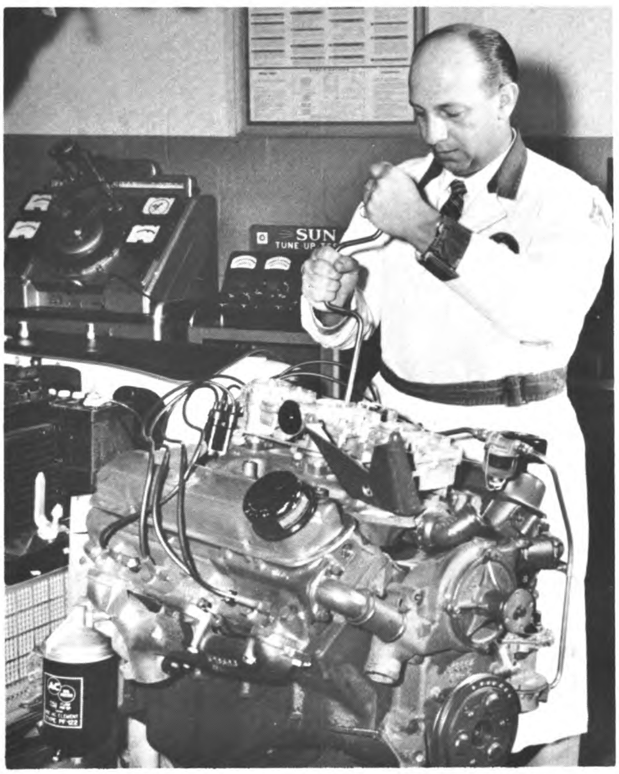
Automobile Mechanics

(D.O.T. 5–81.000 through .999)

Nature of Work

The important job of keeping the 68 million automobiles, buses, and trucks that were registered in this country in 1958 in good operating condition was carried out by approximately 750,000 automobile mechanics. This group of workers made up the largest repair occupation in the labor force.

These skilled workers maintain and repair mechanical, electrical, and body parts of passenger cars, trucks, and buses. In many areas, they may also service tractors and other gasoline-powered equipment. Automobile mechanics make inspections and tests to determine the causes of faulty operation, and repair or replace defective parts to restore the vehicle to proper operating condition. Typical maintenance and repair jobs done by mechanics are tuning the engine, replacing piston rings, alining the front wheels, and adjusting or relining the brakes. On unusual repair jobs, they may be guided by shop manuals and other technical publications.



Automobile mechanic making major repair on engine.

Auto mechanics in the smaller shops are usually general mechanics qualified to perform a variety of repair jobs. A large number of automobile mechanics specialize in particular types of repair work. For example, some mechanics only repair power steering and power brakes, or certain types of automatic transmissions. These mechanics usually work in large shops or in shops that specialize in particular types of repair. However, these specialists usually have an all-round knowledge of automotive repair and may be occasionally called upon to do other types of work. *Body and fender repairmen* are specialists who are usually not required to do other work since they are often trained only in the shaping and finishing of sheetmetal.

In making repairs, the mechanic uses many different kinds of tools. These may range from simple handtools, such as screwdrivers, wrenches, and pliers, to large and expensive machines and equipment designed to diagnose troubles and help the mechanic to correct them. Some of the more common examples of such equipment are wheel alinement machines, brake testers, engine analyzers, headlight aimers, and wheel balancers.

Mechanics usually work by themselves. In large shops, however, the journeyman mechanic may be assisted by a helper or apprentice, and usually works under supervision of a foreman or service manager. Before actually doing the work, mechanics in small shops may be required to prepare estimates of the cost of repairs, including materials and labor. In large shops, the foreman or service manager may prepare the cost estimate.

Where Employed

In 1957, more than three-fourths of the auto mechanics were employed in the service departments of new and used car dealers, and in independent auto repair shops, including general repair establishments as well as shops which specialize in a particular type of repair work, such as battery and ignition repair, body and fender work, radiator service, brake repair, and wheel and axle adjustment.

Many automobile mechanics are also employed by organizations which repair and maintain their own fleets of motor vehicles. Included in this group are Federal, State, and local governments, and trucking, bus, taxicab, bakery, and dairy companies. Other mechanics are employed by manufacturers of motor vehicles to make final adjustments and repairs. Gasoline service stations, most of which provide only minor repairs and adjustments, employ a relatively small number of automobile mechanics.

Most auto mechanics work in shops employing from one to five mechanics. However, some of the largest repair shops employ more than 100 mechanics. Generally, dealers' service departments in large cities have larger staffs of mechanics than independent shops and shops in the smaller communities.

Because motor vehicles are used throughout the Nation, automobile mechanics are employed in every section of the country from the largest cities to the smallest towns. The greatest concentrations of mechanics are found in States with the highest numbers of motor vehicle registrations. In 1958, about half of the motor vehicles were registered in eight States: California, New York, Texas, Pennsylvania, Ohio, Illinois, Michigan, and New Jersey.

Training, Other Qualifications, and Advancement

Most auto mechanics learn the trade through on-the-job experience. Young men usually start as helpers, greasers, or car washers, and gradually acquire the necessary knowledge and skills by working with experienced mechanics. Although a man can perform the simpler types of repair work after a few months' training and experience, it generally takes him at least 3 or 4 years to become a qualified all-round mechanic. Additional training time is usually required for mechanics who wish to become specialists. However, body repairmen, who do not have to acquire a technical knowledge of automotive mechanisms, can learn their trade in as little as 2 or 3 years if they have a knack for handling metal.

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One of the best ways for a young man to become an all-round auto mechanic is through an apprenticeship training program, which usually lasts 4 years. The apprentice may also choose an occupational specialty, such as truck mechanic, bus mechanic, or auto-body repairman.

A large number of automobile mechanics receive training while they are members of the Armed Forces. Before they can qualify as fully trained mechanics in civilian life, however, they may be required to serve an apprenticeship period.

Experienced mechanics employed by automobile and truck dealers are sometimes sent to special centers for further training on mechanical innovations, such as power brakes, power steering, and automatic transmissions.

For beginning jobs, employers prefer young high school graduates who have some understanding of automobile construction and operation and who like mechanical work. Courses in science and mathematics are desirable since they give a young man a better understanding of the principles of internal combustion engines, power transmission by shafts and gears, and electricity. Shop courses in auto repair which are offered by many high schools and vocational schools are valuable. Practical experience gained from working on automobiles as a hobby is also helpful to a young man who wishes to become a mechanic.

Most mechanics are required to have their own handtools. A beginner is usually expected to have about $100 worth of tools. Experienced mechanics usually have over $500 invested in their tools.

There are several advancement possibilities for capable and experienced automobile mechanics. A mechanic in a large shop may advance to a supervisory position, such as repair shop foreman, service salesman, or service manager. Many experienced mechanics ultimately open their own independent repair shops or gasoline service stations.

Employment Outlook

The expected increase in the number of automobiles, trucks, and buses operating on the Nation's highways during the 1960's will create a demand for thousands of additional auto mechanics to maintain and repair these vehicles. The number of automobile mechanics is expected to grow faster than the labor force as a whole. A considerable number of job openings will also be created by retirements, deaths, and transfers of auto mechanics to other fields of work. In this large occupation, retirements and deaths alone will create, on the average, about 12,000 to 15,000 openings each year during the 1960's.

The number of motor vehicles in the United States has increased very rapidly during the past several years. Passenger car registrations increased from 40 million to 57 million, and bus and truck registrations from 9 to 11 million, in the period from 1950 to 1958.

Further increases in motor vehicle registrations are expected in the years ahead. Expected increases in population, household formations, consumer purchasing power, and two-car families will greatly increase the demand for motor vehicles in the 1960's. In addition, the continuation of farm mechanization is expected to increase the number of tractors and other gasoline-powered farm equipment.

Employment of automobile mechanics over the next decade will depend not only on the number of motor vehicles, but also on the amount of repairs required per vehicle and the productivity of the average mechanic. During the 1950's, many features were added to automobiles which made them more comfortable and easier to operate. However, features such as automatic transmissions, power brakes, power steering, and other recent mechanical innovations have also increased the complexity and thus the maintenance requirements of the average car. Despite this increased complexity, mechanics have been able to increase their productivity during this period. New and improved automobile servicing equipment helps in locating and repairing the defects that cause faulty operation. Greater emphasis on replacement rather than on repair of defective parts, better shop management, specialization on just one type of repair, and better training methods have all contributed to the mechanics' increased productivity in making repairs.

Although motor vehicles are expected to become more complex over the next decade, continuing technological developments will enable the average mechanic to service more automobiles, trucks, and buses. Therefore, employment of auto mechanics will grow at a slower rate than motor vehicle registrations.

Earnings and Working Conditions

Mechanics employed in new car dealers' service departments and large independent shops generally earn more than those working in other types of establishments. Skilled mechanics in the large cities generally receive higher wages than those in smaller communities. Earnings also varied among the different specialists, with body repairmen earning more than general automotive mechanics.

Skilled automotive mechanics employed in auto dealers' service departments averaged more than $2.50 an hour in the summer of 1958 in 14 of 29 areas surveyed by the Bureau of Labor Statistics. Straight-time hourly earnings ranged from $2.05 in Providence to $3.16 in Chicago. Mechanics employed by truck, taxicab, and bus companies, and other establishments which service their own vehicles, had hourly earnings ranging from $2.26 in Dallas to $2.88 in the San Francisco-Oakland Area in 1958–59, according to another Bureau of Labor Statistics study of 20 large cities. In 1958, the straight-time average hourly earnings of body repairmen in auto dealer repair shops varied from $2.15 an hour in Providence to $3.35 in Detroit.

Most skilled auto mechanics and body repairmen in automobile dealer repair shops are paid a percentage of the labor cost charged to the customer. Each repair job is assigned a fixed labor charge and the most highly skilled mechanics can earn considerably more than the average because they are able to make repairs in less time. This is especially true in body work, in which there are great differences in skill between the very best repairman and the average repairman. A few body repairmen in large cities earn more than $10,000 a year.

Apprentices are paid a percentage of the journeyman's rate. This percentage ranges from 50 percent of the skilled worker's rate in the apprentice's first 6 months of work to 85 to 90 percent in the last 6 months of the apprenticeship period.

The weekly work schedules of auto mechanics vary considerably—ranging from 40 to 48 hours a week. A considerable number of mechanics work more than 48 hours a week. Long workweeks are especially common in the smaller communities.

Some auto mechanics are members of labor unions. Most union mechanics are employed in shops of the larger new car dealers and the maintenance departments of truck and bus companies. Repairmen are more highly organized on the West Coast but there is some unionization in other parts of the country, particularly in large cities such as Chicago, Minneapolis-St. Paul, St. Louis, New York City, and Cleveland. Many mechanics receive holidays and vacations with pay and are covered by health, insurance, and pension plans. Among the unions to which automobile mechanics belong are the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Business Machine Servicemen

Nature of Work and Where Employed

Business machine servicemen repair and maintain typewriters, adding machines, calculators, cash registers, accounting and statistical machines, and the many other types of machines used in business offices. These machines range in complexity from the relatively simple typewriters and adding machines to the tremendously complex electronic data processing machines. Consequently, the skills required to repair them vary considerably. However, the general work duties and the aptitudes needed in the various jobs are much the same, even, to some extent, in jobs servicing electronic equipment. The main job of business machine servicemen is to test and inspect the machines, diagnose the trouble, and then make the necessary repairs. They repair or replace broken or worn parts, adjust the various mechanisms, and clean and oil the machines. Most adjustments and repairs are made in the offices where the machines are used. However, for overhaul and more extensive repairs, the smaller machines are taken back to the repair shops. Business machine servicemen use common handtools such as screwdrivers and pliers, in addition to special tools designed for the particular machine. They may also be called upon to explain to operators how the machines work and how to avoid damaging them. In some companies, they also sell supplies used with the machines, such as paper, inks, and ribbons.

Business machine servicing offers considerable variety in work assignments. Like some other types of repair work, it requires analytical and reasoning ability. Each repair job presents a new problem, and many persons find considerable satisfaction in being able to diagnose the cause of the trouble and to put the machine back in good working order.

Business machine servicemen are employed in several types of establishments. Manufacturers of business machines employ about one-third of these workers in their sales and service offices throughout the country. Almost half of the servicemen work in small independent establishments, some of which are primarily repair shops, whereas others combine sales and service. The remainder are employed in large organizations which have enough machines to justify employing full-time servicemen. The Federal Government, for example, employed about a thousand of these workers in late 1958.

Business machine servicemen employed in manufacturers' branch offices work only on the manufacturer's products. In the large branch offices, they may specialize in servicing one or two of the types of machines they sell. For example, if the manufacturer makes typewriters, adding machines, and accounting-bookkeeping machines, some servicemen may repair only typewriters and adding machines whereas others may specialize on the accounting-bookkeeping machines. In other companies, even in the larger branches, the men are "combination" servicemen, and work on all the types of machines the company makes. In manufacturers' branches in the smaller cities where there are fewer repairmen, it is impractical to have the men specialize on one type of machine, and most of the servicemen are "combination" repairmen.

Business machine servicemen employed in independent dealers' and repair shops usually work on more than one type of machine because these shops repair and service many makes and models of business machines. Most of them are small and employ only a few servicemen. However, in some of the larger independent shops, most of the repairmen may specialize on typewriters and adding machines of various makes which furnish the bulk of their business, while a few other men repair the more complicated machines.

Business machine servicing jobs are found throughout the country. Even relatively small communities usually have at least one or two shops which repair machines. However, most business machine servicemen work in large cities, especially those with concentrations of office workers, such as New York or Washington, D.C.

Typewriter Servicemen (D.O.T. 5–83.127). An estimated 17,000 servicemen were engaged primarily in repairing and maintaining typewriters in late 1958, making this the largest business machine repair occupation. Typewriters are the most widely used business machines. In addition to practically every business office, they are used by many individuals in their homes. Electric typewriters differ somewhat in operation from mechanical typewriters, but the two types are enough alike that the repairmen can usually learn to repair the electric machines after a brief period of additional training.

Typewriter repairmen are employed both in the local service branches of typewriter manufacturers and in independently owned local repair shops (which frequently sell typewriters as well as repair them). Many servicemen operate their own shops. Typewriter servicemen are found in almost every sizable community throughout the Nation.

Adding Machine Servicemen (D.O.T. 5–83.122). In late 1958, more than 2,000 servicemen were engaged mainly in the servicing of adding machines. These machines are simpler to repair than most other business machines. Their repair is often regarded as a training job in which an inexperienced man can gain experience before learning how to repair more complex machines. In some cases, servicing of both adding machines and calculators is combined in a single job. In independent repair shops, adding machines are often serviced by mechanics who also repair typewriters.

Adding machine servicemen are employed both in manufacturers' service branches, which are operated in connection with the sales offices of the firms, and in independently owned local repair shops. Other sources of employment are the Federal, State, and local governments, and a few large banks and other firms which use large numbers of adding machines.

Calculating Machine Servicemen (D.O.T. 5–83.123). About 4,000 servicemen were employed primarily in the repair and maintenance of calculating machines in late 1958. These machines, which have elaborate mechanisms, add, subtract, divide, multiply, and perform combinations of these operations. Calculating machine servicemen require more training than typewriter or adding machine repairmen. In some cases, servicing of calculators is combined with the servicing of other business machines, particularly adding machines and accounting-bookkeeping machines.

Men who service calculators are usually employed in manufacturers' local service branches which are operated in connection with the sales

The main jobs of the calculating machine repairman are to test and inspect the machines, diagnose the trouble, and then make the necessary repairs.

offices of these firms. However, a few work in independently owned local repair shops, most of which are small and employ only a few workers. Another source of employment is the Federal Government. Most servicemen are employed in the larger cities, where most of the calculators are used.

Cash Register Servicemen (D.O.T. 5–83.124). Cash register repair and maintenance was the main work of more than 4,000 business machine servicemen in late 1958. Next to typewriters, cash registers are the most widely used business machines. Cash registers vary greatly in complexity. The simplest models merely record transactions and total receipts and provide a change drawer. The more complicated cash registers tabulate several different kinds of information simultaneously on each transaction, such as identification of the clerk, department, type of merchandise, payment given, and change due, and provide printed receipts for the customer.

The great majority of servicemen primarily engaged in repairing cash registers are employed in the local service branches of the few manufacturing firms in this field. Some of the repair work, especially in smaller towns, is done in independently owned local shops which also repair other types of business machines.

Accounting-Bookkeeping Machine Servicemen (D.O.T. 5–83.121). In late 1958, the repair of accounting-bookkeeping machines was the main job of about 3,000 business machine servicemen. These machines perform a variety of operations. Some post entries, some do billing, whereas others combine the functions of typewriters and computing devices. All models have keyboards, like typewriters and adding machines. These machines are used in firms which have a great deal of accounting and bookkeeping work, such as department stores, large retail and wholesale businesses, and banks. Many of the newer models are adjusted specifically for the accounting procedures used in a given customer's office. Servicemen set up the controls or programs for these machines from plans which have been drawn up by the customer and the salesman.

These servicemen are employed principally in large cities, where most of these machines are used. Most accounting-bookkeeping machine servicemen are employed in the local service branches of companies manufacturing this equipment. Only a small number work in independent repair shops.

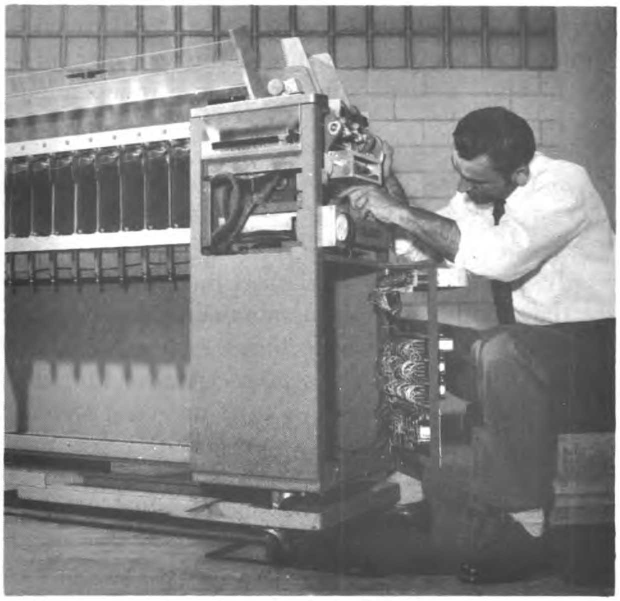
Accounting-Statistical Machine Servicemen (D.O.T. 5–83.126). In late 1958, more than 10,000 men were employed in maintaining and repairing accounting-statistical machines. These are the most skilled business machine servicemen. Accounting-statistical machines record, tabulate, and analyze great masses of accounting and statistical data. They include card punches, sorters, and tabulators, as well as special purpose machines used in punched card systems, such as collators, verifiers, multipliers, and reproducers.

New lines of electronic accounting-statistical machines (computers) which process tremendous masses of data with great speed came into use in the 1950's. Most of these machines are manufactured by the same firms which produce the electro-mechanical accounting-statistical machines.

Electronic machines combine mechanical features with electronic circuits and components, therefore, repairmen servicing these machines need a knowledge of electronics in addition to mechanical skill. About 3,000 of the more than 10,000 accounting-statistical machine servicemen specialize in servicing the new electronic machines. In some firms, only men with training in electronics are hired to service these machines. Many of these men have learned electronics in technical schools or in the armed services. In other companies, experienced men who can repair other types of business machines are given training in electronics by their employers.

Accounting-statistical machine servicemen are employed principally by a few firms which manufacture and service this equipment. They may be assigned by their companies to work anywhere in the United States, but they are usually stationed in one of the larger cities. They rarely transfer from one company to another.

Dictating Machine Servicemen (D.O.T. 5–83.135). Dictating machines are used in business offices to record dictation on cylinders, discs, or sleeves which can be played back for typing. The newer dictating machines are electronic models which reproduce the voice much more faithfully than the older acoustic-type machines.



Serviceman making repairs on data-processing machine.

Servicing is still largely a matter of mechanical aptitude since the mechanical sections of dictating machines break down more frequently than the electronic parts; however, the servicemen must have a working knowledge of electricity and electronics. Besides the standard office dictating machines, there are many special types, such as devices which record telephone conversations or conferences, which are maintained by dictating machine servicemen. About 2,000 men were employed in this small field in late 1958.

Dictating machine repairmen are employed mainly in the larger communities either by the service branches of the manufacturers or by their distributors. In small towns, typewriter and adding machine repairmen may also learn to service dictating and transcribing machines.

Training, Other Qualifications, and Advancement

Business machine servicemen are generally hired as trainees, and acquire their skills through on-the-job training and work experience. In manufacturers' service branches, the men may also receive instruction in a company school. The length of training varies greatly with the type of machine serviced and the kind of shop in which a man is employed. The time required to become a skilled serviceman tends to be somewhat longer in independent shops because of the greater variety of work and the less formal nature of the training. Formal apprenticeship programs of from 2 to 4 years are conducted by some firms.

Most companies which have factory-authorized service branches prefer to hire young men without previous experience and train them to service just their line of machines. Independent shops, on the other hand, require men who can service various makes of machines, and will either hire men with previous experience or will give a new man informal training on several different types of machines.

Men newly hired for servicing work in the manufacturers' service branches are usually sent to a company school for several weeks of classroom work. They then receive 1 to 3 years of practical experience on a job before they are considered skilled workers. At some time during this period, the servicemen may be sent back to the company school for a few weeks to learn to repair more complicated machines. Even after becoming a skilled worker, a serviceman may occasionally return to the company school to take a special course in maintaining a new type of mechanism.

Men in independent shops generally learn the trade by working with experienced repairmen, who instruct them in the techniques of the trade. Occasionally, men employed by an independent or franchised dealer will be sent to a manufacturer's school for a few weeks at the dealer's expense to learn to repair a particular make of machine. In most cases, however, men in independent shops receive no formal training.

Length of training depends largely on the type of machine the man is learning to repair, with the more complicated machines requiring the longer training periods. Typically, it takes from 1 to 2 years for a man to learn to repair an ordinary adding machine or a typewriter. Calculating machines require from 2 to 4 years of training and experience. Cash register repairmen learn their job in from 2½ to 3½ years, the last 6 months of which are usually spent in the company school. Skilled accounting-bookkeeping machine repairmen generally must have at least 4 to 5 years of training and experience. The first 1 or 2 years may consist of working as an adding machine, calculator, or cash register repairman, since this is considered valuable background for servicing accounting-bookkeeping machines.

Most accounting-statistical machines contain electrical equipment in them; many have electronic components. The companies which manufacture and service these machines, therefore, often require that applicants have some knowledge of electricity or electronics. In qualifying for a job in the maintenance of the complex electronic data-processing machines, college or technical institute courses in engineering are helpful, though not essential. Young veterans who have had electronics training in the Armed Forces are especially desired by employers in this field. Men hired as trainees generally spend their first 2 months in on-the-job training. If they prove satisfactory, they are sent to a company school for a period of from 3 to 10 months. After completing the course, they work under supervision until they acquire enough skill to service and repair on their own. This period usually lasts from 12 to 18 months.

The qualifications generally needed for business machine servicing work are high school education and general mechanical aptitude. Neatness in dress and personal appearance and the ability to get along with people are desirable for this work because much of the servicemen's time is spent on customers' premises. Most companies place great emphasis on hiring men who can make personal contacts effectively. Most manufacturers' branch offices prefer to hire young inexperienced persons as trainees. These employers also give aptitude tests to prospective servicemen. Previous experience in other business machine companies is given little consideration in some of the larger companies, although some do credit it as partial training. Such experience is much more helpful in obtaining a job in a small independent shop which handles all makes of machines.

Servicemen in manufacturers' sales branches frequently have the opportunity to move into sales jobs, where their earnings are usually greater. In some cases, service and sales work are combined. Many of these men also have the opportunity for promotion to supervisory jobs, such as foreman or service manager; men in large independent shops have similar opportunities. Experienced men sometimes open their own repair shops; men who work in the branch offices of some manufacturers are sometimes given sales franchises from the company and become independent dealers.

Employment Outlook

During the 1960's, employment of business machine servicemen is expected to grow at a fairly rapid rate—somewhat faster than the estimated 20 percent increase for the Nation's total working force. The need for these workers will arise both from the increasing use of office machines in business and industry, and the greater maintenance requirements of the newer, more complicated equipment. Replacement needs will also provide some openings for new workers. However, business machine servicing is not a large field of work and only a few thousand young men will be able to enter this growing occupation each year.

Since the turn of the century, both private business firms and governmental bodies have experienced a great increase in the amount of clerical work required for conducting their business. With the greatly increased use of scientific management methods, the need of business for more and more records, correspondence, and reports expanded greatly. Millions of business machines have enabled clerical and administrative staffs to handle this greatly increased workload. The new electronic machines introduced in the 1950's have not only made vast improvements in accounting technique, but have also created a demand for better and more extensive records. Coordinating the multitude of operations of a huge corporation, insurance company, or Government agency and relating them to other developments in a fast-moving, highly industrialized economy is a job which demands information that is more and more accurate, timely, and voluminous, and which can be obtained only through the use of modern office machines.

The increased use of business machines and the greater complexity of this equipment have resulted in a significant rise in the number of servicemen. Employment in this occupation doubled in the post-World War II decade, rising to more than 40,000 by late 1958. Continued growth in employment of business machine servicemen is expected during the 1960's. Some types of servicing work will grow faster than others. The greatest growth is anticipated for men who service electronic accounting-statistical and data-processing machines.

The need to replace servicemen who are promoted, transfer to other fields of work, retire, or die will also provide job opportunities for new workers. Since this is a relatively young group of workers, retirements and deaths will result in only about 500 to 600 openings annually.

Employment of servicemen tends to hold up fairly well through periods of fluctuation in general business activity. In prosperous periods, sales of business machines generally increase, resulting in increased demand for servicemen. In less favorable times, sales of new machines have generally declined, but the increased wear and tear on the machines in use create a continuing need for maintenance work. Men who establish themselves in this field, particularly those employed by the large national concerns, are fairly well assured of continuing employment for many years.

Earnings and Working Conditions

In late 1958, earnings of experienced servicemen generally ranged from $80 to $130 a week depending on where the man was employed, the type of machine he serviced, and his length of service with an employer. Wages were lowest for men who repair only typewriters or adding machines; the earnings of these workers usually ranged from about $80 to $95 a week. Cash registers, calculators, bookkeeping-accounting machines, and nonelectronic accounting-statistical machines require more skill to repair; consequently, the men who work on them receive somewhat higher pay rates, generally ranging from $90 to $120 a week. Highest rates are received by men who service electronic data-processing machines. The most highly skilled electronic computer servicemen were earning as much as $185 a week in late 1958. In addition to their salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Men employed by larger manufacturers are covered by pension and group insurance plans.

Servicemen trainees begin at wages considerably below these levels, and receive pay increases as they become more and more skilled during the training period. Starting wages generally ranged from about $50 to $70 a week in late 1958. Men with prior electronics training in Armed Forces or civilian technical schools generally receive somewhat higher beginning wages.

Servicing and repairing business machines is cleaner and lighter work than most other mechanical trades. The occupation is comparatively free from the danger of accident. Servicemen generally dress like office workers, since the work is clean and is often performed in the offices where the machines are used. Many of these jobs involve considerable traveling within the area served by the employer.

Diesel Mechanics

(D.O.T. 5–83.931)

Nature of Work

Diesel mechanics are responsible for keeping diesel engines in good operating order. They diagnose the trouble of defective engines, repair or replace broken or wornout parts, or make adjustments on fuel and air valves. When doing a major overhaul, the diesel mechanic takes the entire engine apart; examines the pistons, valves, fuel injection parts, connecting rods, and other parts for defects; and replaces or repairs defective parts. He then reassembles and adjusts the engine.

Many of the men who repair diesel engines are specifically trained for this type of work. Because the basic parts of the diesel and the gasoline engine are similar (although they have different fuel feeding and firing systems), diesel engines are also often repaired by workers who are trained in gasoline engine maintenance. On the railroads, generally, the repair and maintenance of diesel locomotives is performed by electricians and machinists.

Diesel mechanics use handtools, such as pliers, screwdrivers, and wrenches. Sometimes they use machine tools, such as grinders, drills, and lathes to machine simple replacement parts for the engine.

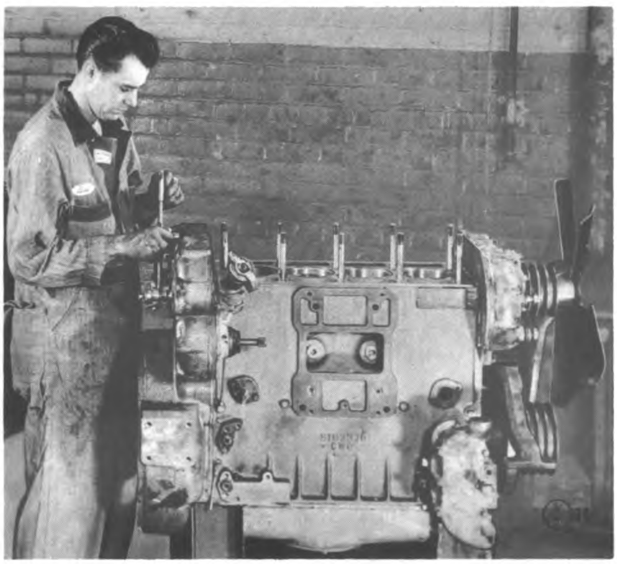
Where Employed

Because diesel engines are widely used in American industry and commerce, diesel mechanics are employed in all parts of the country. The greatest concentrations of these workers, however, are in California, Texas, New York, and Pennsylvania. Among the important sources of employment are buslines, trucking companies, railroads, shipping lines, electric power plants, logging camps, marine-engine repair establishments, and garages and firms that service farm diesel tractors and construction machinery.

Training and Other Qualifications

Most diesel mechanics enter the trade by first learning how to repair gasoline engines. They usually start as helpers to automotive gasoline engine mechanics and acquire their skills by working with the more experienced craftsmen. Although it is possible for men to perform the simple types of gasoline engine repair work after a few months' training and experience, it generally requires 3 to 4 years to be qualified to do all types of gasoline engine repairs.

After mechanics have demonstrated their ability with these engines, firms that use or repair diesel engines may give them a chance to learn to repair diesel motors. Additional experience on diesel engine repair, usually ranging from 6 months to 1½ years, is generally required before young men can qualify as journeymen diesel mechanics. While learning the trade, many young men have found it helpful to take courses in the theory and practice of diesel engine repair and maintenance offered by vocational and trade schools.



Diesel mechanic overhauling a diesel truck engine.

Some diesel mechanics learn their trade through apprenticeship programs. These programs, which generally last 4 years, give the trainees a combination of classroom training and practical experience. Apprentices receive classroom instruction in blueprint reading, hydraulics, welding, and other subjects related to the occupation. In their practical training, they work with valves, bearings, injection systems, starting systems, cooling systems, and other parts of the diesel engine. They also learn how to repair and maintain gas engines, air compressors, and other equipment.

Mechanics employed in servicing and repairing diesel locomotives are required to serve a 4-year apprenticeship. This apprenticeship program includes specialized training related to the repair of railroad equipment. Marine engineers, who are in charge of the operation and maintenance of diesel engines on ships, must be licensed by the U.S. Coast Guard. Experience in the engine department of ships and written examinations are among the requirements for marine licenses.

Employment Outlook

An increasing number of diesel mechanics will be needed in the 1960's to maintain and repair the ever-growing number of diesel engines being used in American industry and commerce and on the roads and farms of the country. In addition to the new jobs which are expected to develop because of the more widespread use of diesel engines, many job openings will result when workers retire, die, or transfer to other fields of work.

Over the past several decades, the diesel engine has proved to be a reliable and economical source of power for locomotives, trucks, buses, tractors, ships, construction machinery, and for many kinds of stationary machinery, such as pumping equipment, oil drilling equipment, and electric power generators. The growing use of diesel-powered trucks and buses illustrates the increasing importance of the diesel motor as a source of power. The number of diesel-powered trucks and buses registered in the United States increased from 104,000 in 1953 to 188,000 in 1957. The number of diesel-powered locomotives increased from 24,000 in 1953 to 28,000 by the middle of 1956 despite an overall decline in the total number of railroad locomotives.

It is expected that the economic advantages of the diesel engine as a source of power will result in its continued widespread use in the future. Most industries which use diesel engines in large numbers are expected to expand their activities considerably during the 1960's. The Federal Government's multibillion dollar highway development program will require large numbers of additional diesel-powered bulldozers, cranes, and other construction machinery. The trend toward increasing farm mechanization is expected to continue, resulting in the use of many new harvesters, tractors, and other diesel-powered equipment. Also, the number of diesel-powered trucks and buses in the transportation industry probably will increase.

The expanding petroleum industry will need many new diesel engines to run generators which supply power for drilling or pumping equipment. Diesel power will also be used to a greater extent in mining—for example, uranium mining, in which diesel engines are used to power ventilating, drilling, pumping, and hauling equipment is expected to grow. The growth of these industries and, consequently, the greater need for diesel engines will result in a substantial increase in the number of jobs for diesel mechanics.

Most new job openings in this field will be filled by mechanics who have had experience in repairing gasoline engines. Companies changing over to the use of diesel engines usually retrain their experienced mechanics to service the diesel equipment. Companies which buy additional diesel engines to meet expansion needs try to hire experienced diesel mechanics wherever possible. Men who have had school training but no practical experience in diesel repair work may be able to find jobs as trainees; however, they will find few opportunities to start as full-fledged mechanics.

Earnings and Working Conditions

Although no national data are available on the earnings of diesel mechanics, wage data collected from a few employers and union contracts indicate that these workers were earning from $2 to $2.50 an hour in late 1958. Diesel mechanics employed in some local and intercity bus repair shops earned between $2 and $2.45 an hour in October 1958. Mechanics employed by railroad companies to repair diesel locomotives had average straight-time hourly earnings of approximately $2.48 in May 1958.

Most of the larger repair shops are pleasant places in which to work, but some of the small shops have poor lighting, heating, and ventilation. If proper safety precautions are not taken, there is some danger of injury to men working on vehicles supported on jacks or blocking. In most jobs, the mechanics handle greasy tools and engine parts, and it is often necessary for them to stand or lie in awkward or cramped positions for extended periods of time.

Many diesel mechanics belong to labor unions. Some of the unions to which they belong are the International Association of Machinists; the Sheet Metal Workers' International Association; and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America, and the International Brotherhood of Electrical Workers.

Electronic Servicemen and Technicians

Young persons interested in electronics—who do not expect to obtain a college degree—will find many employment opportunities for jobs as skilled workers in this rapidly growing field. Workers who have an understanding of electronic principles have many different job titles and duties. The job requirements of these servicemen and technicians range from those needing only an elementary knowledge of electronics to those demanding a comprehensive understanding of electronic theory. (This chapter principally covers the workers who service and repair electronic equipment. Many of the jobs of the more highly trained electronic technicians are discussed in greater detail in the chapter on Technicians.)

The particular job duties of electronic servicemen and technicians and their job titles, depend on the industry in which they are employed and the type of equipment on which they work. Among the jobs requiring a knowledge of electronics are: Radio and television repairmen, broadcast technicians, radio and radar operators, and electronic-data machine servicemen. In addition, there are electronic servicemen and technicians who perform jobs directly related to production work in manufacturing companies. Other highly trained technicians assist engineers in the design of electronic systems and equipment for electronic manufacturers and guided missile and aircraft producers. (For additional information, see chapter on Technicians which appears elsewhere in this Handbook; refer to index for page numbers.)

Nature of Work and Where Employed

The rapid growth of radio and television, the greatly increased use of electronic equipment by the Armed Forces, and the growing application of electronics to a wide range of commercial and industrial processes have created a great demand for persons qualified to construct, install, maintain, and repair electronic equipment. This equipment includes devices which make use of vacuum tubes or transistors such as home radio and television sets, radar, guided missile controls, and electronic computers.

Radio, television, and other electronic servicemen and technicians diagnose the trouble in equipment, conduct tests to verify or correct their diagnosis, and then make the necessary repairs. In manufacturing, these technical workers construct, install, test, and maintain electronic devices. In radio and television manufacturing, these workers generally referred to as technicians, concentrate on testing, inspecting, and troubleshooting. In aircraft plants, they are most often concerned with the installation of electronic equipment. Technicians in broadcasting stations—who have job titles such as transmitter technician, studio technician, and maintenance technician—operate transmitters, and read transmitter meters. They also operate television cameras and microphones, take charge of recording and sound effects equipment, and maintain and repair equipment. (Additional information about electronic servicemen and technicians appears in the chapters on Radio and Television Broadcasting; Electronics Manufacturing; Aircraft, Missile, and Spacecraft Manufacturing elsewhere in this Handbook. See index for page numbers.)

An estimated 170,000 electronic servicemen and technicians were employed in a variety of industries and activities in 1958. (This number includes the more highly trained electronic technicians discussed in the chapter on Technicians.) Radio and television servicemen, numbering about 85,000, were by far the largest group. More than 35,000 electronic technicians were employed in manufacturing industries, principally in plants producing radio and television sets, military and commercial electronic equipment (including guided missiles), and aircraft. Radio and television stations employed about 19,000 men (5,000 of whom are supervisors) as broadcast technicians. The Federal Government and commercial airlines employed several thousand electronic technicians to maintain and repair radio and radar equipment used for guiding and communicating with aircraft in flight. About 1,500 radio operators worked for ocean shipping firms, maintaining radio and radar apparatus. Firms which manufacture electronic data-processing machines employed about 3,000 electronic technicians as customers' servicemen to install, maintain, and repair this equipment. State and local governments employed in excess of 4,000 electronic servicemen and technicians to maintain their radio and radar equipment. A few thousand electronic technicians also worked in independent research firms and in research laboratories.

The Armed Forces use a tremendous amount of electronic equipment which is kept in good operating condition by three different groups of electronic technicians. Uniformed personnel make up the largest of these groups. In 1958, more than a quarter of a million members of the Armed Forces were engaged in operating or maintaining electronic equipment, with somewhat more than 100,000 specializing in the maintenance of such equipment as radio, radar, guided missile controls, fire control instruments, and other military electronic devices. (These workers are not included in the statistics or the descriptions given in this chapter.) About 15,000 electronic servicemen and technicians worked as civilian employees of the Armed Forces, performing skilled electronic maintenance work. The third group was made up of several thousand highly skilled electronic technicians employed by electronic equipment manufacturing firms which service the more complex electronic equipment at military and other government installations on a contract basis.

Because the work duties of electronic servicemen and technicians are somewhat different, depending on the job they perform and the industry in which they are employed, a description of the nature of the work in four of the main specialized fields is given below.

Radio and Television Repair. Radio and television servicemen analyze and test home radio and television receivers requiring repairs to determine the location and nature of the trouble. They may use test equipment such as oscilloscopes, signal generators, voltmeters, and ohmmeters to trace and measure the flow of current through the various components in the circuits. When they have located the part or circuit which is not working properly, they make the necessary repairs. They replace wornout tubes, condensers, resistors, and other parts, using electricians' handtools, such as pliers, screwdrivers, wrenches, and soldering gear. After making repairs, they adjust the equipment to proper operating condition. Radio and television servicemen make most major repairs on radio and television sets in the shop; minor repairs and adjustments are usually made in customers' homes. Some servicemen also install television antennas on roofs or in attics, running wire from the antenna to the television set.

Television repairman checking television receiver.

Many radio and television servicemen work in small 2- or 3-man repair shops, often as partners. Some are employed in large repair shops, including service branches of large manufacturing companies. Appliance stores, department stores, and other outlets selling radio and television sets also employ these workers in their service departments.

The geographical distribution of radio and television servicemen generally follows the pattern of the distribution of television sets, most of which are located in the larger cities. In 1958, the metropolitan areas with the largest number of television sets in use were: New York, Chicago, Los Angeles, Philadelphia, and Detroit.

Radio and Television Manufacturing. Electronic technicians employed in plants manufacturing home radio and television receivers perform a variety of tests and inspections on subassemblies and sets as they pass through the assembly line. They also test, adjust, and repair completed receivers. Electronic technicians make the more complex tests themselves, and they set up testing equipment to be used by less skilled workers in making routine tests. Generally, they use the same types of testing instruments and handtools as radio and television servicemen. In 1958, the largest concentration of these technicians was in the Chicago area, with New York, Philadelphia, and Los Angeles, also being important centers for radio and television manufacture.

Military and Commercial Electronic Equipment Manufacturing. Unlike radio and television factories, plants producing electronic equipment such as radar, electronic computers, transmitters, and guided missile controls are not organized on a mass production basis. Small orders of specially designed units make up most of the output of these plants. As a result, these firms devote a large proportion of their efforts to research, engineering, intricate assembly, and testing.

Electronic technicians are used in these operations. Although their job duties are similar in many respects to those of technicians in radio and television manufacturing, most of these jobs require even greater skill. Assembling complicated parts of the equipment, making tests and inspections, and tracing and repairing defects in finished units are among the many tasks performed by these workers. Because the products of these plants are not made in large quantities, the tests and other operations are not generally repetitive.

More than half of the electronic technicians engaged in making military and commercial equipment were employed in the New York, Philadelphia, Chicago, Boston, Los Angeles, and Baltimore metropolitan areas in mid-1958.

Aircraft and Missile Manufacturing. Military and commercial aircraft and guided missiles are equipped during their manufacture with a considerable amount of electronic equipment. It has been estimated that electronic devices account for from one-third to one-half of the cost of military aircraft. (Guided missiles contain even more electronic equipment.) Building this equipment into aircraft and missiles and putting it into good working order require the services of a great many electronic technicians. Job duties of these workers include attaching electronic units to the airframe, or missile shell; connecting and wiring the equipment; and testing the components, subassemblies, and final installation. (For additional information, see chapter on Technicians. See index for page numbers.)

In general, these technicians are distributed geographically in about the same way as aircraft and guided missile manufacturing workers. In 1958, some of the metropolitan areas with heavy concentrations of these technicians were Los Angeles, Boston, New York, Seattle, San Diego, Wichita, Hartford, Fort Worth, and Dallas.

Training and Other Qualifications

To qualify as an electronic serviceman or technician, a young person must have an understanding of electronics theory and principles. In addition, in order to specialize in a particular field, this knowledge of electronics must be supplemented by the work experience or further training.

In the early days of radio, knowledge of electronics was usually acquired by home reading and independent study. Although it is still possible for young men to acquire a knowledge of electronics this way, jobs in electronics are becoming more complex and difficult to perform and require more formal training.

There are several ways by which a young person may obtain formal training in electronics. Vocational or trade school training has provided the basic background for many radio and television servicemen.

Since World War II, training received in Armed Forces technical schools has helped thousands of veterans to qualify for civilian electronic specialists jobs. Young men interested in this field who are thinking of entering the Armed Forces would do well to investigate the opportunities for valuable electronic training and work experience they offer.

Apprenticeship is a good method to prepare for this occupation, but only a small proportion of servicemen and technicians are currently being trained by this method. However, apprenticeship training is being adopted by some of the larger employers. These apprenticeship programs generally last 4 years and provide the apprentice with well-rounded training in electronics theory and practical skills.

Most training authorities recommend a 1- or 2-year course in electronics at a good technical school or institute as the best preparation for a high level electronics job. To enter a technical institute, a person should be a high school graduate who has successfully completed courses in algebra and trigonometry. Technical institutes provide classroom and workshop instruction in the fundamentals of electronics. (See chapter on Technicians for a detailed discussion of technical institute training.) More than half of the electronic technicians interviewed in a survey conducted by the Bureau of Labor Statistics in eight of the largest cities had received civilian technical school training. The proportion was even higher among the younger men; two-thirds of the technicians under 30 years of age had had technical school training.

Because of the rapidly changing nature of electronics, workers in this field must continue training throughout their working career. Many manufacturing plants conduct short training programs as new designs and methods are developed. Electronic servicemen and technicians also may keep abreast of new developments through reading trade literature and attending lectures, demonstrations, and discussion groups sponsored by firms and associations.

Among basic qualifications necessary for the job of the electronic serviceman or technician is a good background in mathematics and physics. Manual and finger dexterity is essential since they work with small handtools and delicate equipment; good eyesight and color perception are other important qualifications.

Although applicants for beginning jobs in each of the different electronic fields are required to have at least an elementary knowledge of electronics, additional qualifications sought by employers vary somewhat from one type of work to another. For radio and television service jobs, men who can deal with customers courteously and effectively are preferred. Manufacturers of military electronic equipment and aircraft prefer men who have served in the Armed Forces as electronic technicians and are, therefore, familiar with this type of equipment. Many employers consider "ham operator" experience as valuable background for servicemen and electronic technicians. They often give preference to applicants with this type of background. Employers often prefer technical school graduates for the high level technician jobs. Nevertheless, men in beginning jobs who do not have this training but who are capable of learning advanced electronics theory, can advance to these jobs by taking night school, correspondence, or other types of courses.

Employment Outlook

Electronic servicemen and technicians will continue to have excellent opportunities for employment in the 1960's. Not only will employment grow in existing fields of electronics, but many new areas of electronics work are expected to develop. The potentialities of electronic equipment are just beginning to be exploited. Just as our Armed Forces have come to depend heavily upon electronic equipment, so too will civilian industries find more and more applications for electronics.

Employment of radio and television servicemen will continue to increase moderately during the 1960's. For example, in the established television areas, the amount of television repair work will increase slowly as the trend toward 2- and 3-set homes continues. The widespread introduction of color television in the coming decade also is expected to increase the demand for servicemen. Present color television equipment is more complicated than black and white television, and requires greater skill on the part of the servicemen. The impact of color television on employment of servicemen will be most strongly felt during the 1960's, when color receiving sets probably will be installed in great numbers. However, as color television sets come into wider use, it is expected that improvements in design will make them simpler in construction and less susceptible to breakdown. In addition, as has been the case with black and white television, servicemen will become better acquainted with the color equipment and more efficient in making repairs. For these reasons, and because a color set will usually replace a black and white set in the user's home, the long-term effect of color television on employment of servicemen is expected to be moderate.

A substantial increase in employment of electronic technicians is expected in plants manufacturing military and commercial electronic equipment, guided missiles, and aircraft. An increasing share of Government expenditures for defense will be used to purchase electronic equipment for aircraft, guided missiles, and other military items. The demand for civilian electronic equipment also is expected to increase considerably. Greatly increased use of electronic control equipment in manufacturing, communication and navigation equipment in transportation, and electronic data-processing machines in business offices will result in increased employment of these workers in plants making this equipment.

Although the rate of growth in the different electronics fields is expected to vary, the fact that trained men are often able to transfer between fields makes these differences in outlook not too significant.

Earnings and Working Conditions

There is a relatively wide range of earnings among electronic servicemen and technicians.

Beginning workers were earning $50 to $60 a week in 1958, whereas some of the more experienced men in certain specialized fields, such as radio and television broadcasting, were earning more than $185 a week.

Although beginning radio and television servicemen were among the lowest paid of all these technical workers, earnings of journeymen varied widely, with most servicemen earning from $80 to $130 a week in 1958. Generally, servicemen in the larger cities had the highest earnings. After several years of experience, radio and television servicemen have the opportunity of opening their own repair business.

Because of the considerable variation in skill requirements among electronic technician jobs in manufacturing, pay rates have a wide range. Technicians employed in companies manufacturing military and commercial electronic equipment generally earned from $1.75 to over $3 an hour in 1958. Electronic technicians employed in radio and television manufacturing generally were paid hourly rates ranging from about $1.75 to $2.50 in the same year. (Some of these men find it possible to supplement their earnings by repairing television sets in their spare time.) Electronic technicians employed in aircraft manufacturing in 1958 earned from $2 to $3 an hour.

Electronic technicians employed in manufacturing usually work the normal 5-day, 40-hour week, and receive time-and-a-half pay for overtime hours. Overtime work is more common in aircraft and military and commercial electronic equipment manufacturing plants than in other factories because of the complex scheduling problems in these industries. Radio and television repair shops, most of which are small establishments, usually have longer working hours. Although some of the largest shops have a 40-hour week, the 6-day, 48-hour week is the more common work schedule. Evening and weekend work is very common among radio and television servicemen.

Radio and television repair work is usually carried on indoors in pleasant, well-lighted surroundings. When repairs are to be made in customers' homes, servicemen must drive to the home, carry in their testing equipment and tools, and work in whatever space is available near the television set. Some physical strain is involved in carrying sets from customers' homes to the shop and back again. Perhaps the most hazardous work in this field occurs when new antennas are installed on roofs. In the repair operation itself, the major hazard is electrical shock, though serious injury from shocks is rare.

Plants engaged in manufacturing radio and television sets, electronic equipment, and aircraft are usually clean, well lighted, and well ventilated. The work in these factories is usually not very strenuous physically. Work assignments in aircraft and electronic equipment plants may change frequently, giving the job a freedom from monotony which most technicians find desirable.

Where To Go for More Information

Vocational training information may be secured from the U.S. Department of Health, Education, and Welfare, Office of Education, Division of Vocational Education, Washington 25, D.C.

For further information about technicians, see chapter on Technicians which appears elsewhere in this Handbook. Refer to index for page numbers.

Industrial Machinery Repairmen

(D.O.T. 5–83.641)

Nature of Work

The increasing amount of machinery being used by American industry is creating a greater demand for skilled industrial machinery repairmen. These workers, often called maintenance mechanics, maintain and repair machinery and other mechanical equipment used in a great variety of manufacturing establishments. When breakdowns occur, the repairmen must determine the cause of the trouble and make the necessary repairs so that the equipment is returned to good running order. To do this, they may dismantle or partly dismantle a machine in order to repair or replace defective parts. After the machine is reassembled, they usually make the necessary mechanical adjustments to insure correct operation.

A good part of the repairman's time is spent in preventive maintenance. By regularly oiling and greasing machines, replacing belts, and cleaning and repairing parts, he tries to prevent trouble which could cause a breakdown of operations. In large establishments, he may keep a maintenance record of the equipment he services. An industrial machinery repairman uses wrenches, screwdrivers, pliers, and other handtools, as well as portable power tools, in his work. He may also use welding equipment in repairing broken metal parts.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They also use parts catalogs to order replacements for broken or defective parts. Occasionally, the repairmen may sketch a part which is to be replaced by the plant's machine shop.

Where Employed

Industrial machinery repairmen are employed in almost every type of industrial plant which uses any great amount of machinery or equipment. Metalworking establishments, in particular, employ large numbers of these workers. For example, in early 1958, the machinery manufacturing industry (electrical and nonelectrical) employed about 50,000 maintenance mechanics and the automobile industry employed 9,000. Plants manufacturing goods other than metal products, such as textile mills, petroleum refineries, and paper and pulp mills, also employed many of these skilled craftsmen.

Because industrial machinery repairmen do maintenance work in such a wide variety of industries, they are employed in every section of the country. However, the greatest concentration of these workers is in New York, Pennsylvania, Ohio, Illinois, Michigan, California, New Jersey, Massachusetts, and other heavily industrialized States.

Training and Other Qualifications

Most workers enter this occupation by working as helpers and picking up the skills of the trade through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both shop training and related classroom instruction. Apprentices learn the use and maintenance of the tools of the trade, the operation of the machinery and equipment which they will maintain, and the lubrication and adjustment of machinery. Classroom instruction is given in mathematics, blueprint reading, hydraulics, welding, and other subjects related to the craft.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility are also necessary, because industrial machinery repairmen are sometimes required to lift heavy objects or do considerable climbing in order to repair equipment located at high levels.

Employment Outlook

An increasing number of industrial machinery repairmen will be needed in the 1960's to maintain and repair the growing amount of machinery and equipment being used in American industry. A substantial expansion in new plants, machines, and industrial equipment is expected in the 1960–70 decade in the industries which employ the largest number of repairmen.

The use of more expensive and complicated machinery is making repair work and preventive maintenance more essential. As production methods become more automatic and more integrated, manufacturers suffer greater losses from machinery and equipment breakdowns. The trend toward the use of more machine tools, transfer equipment, and assembling equipment in mechanized (automated) lines will require the employment of increasing numbers of industrial machinery repairmen.

In addition to the new job openings for industrial machinery repairmen created by industrial expansion, thousands of new workers will be needed in the next decade to replace those who retire, die, or transfer to other fields of work.

Earnings and Working Conditions

Wage surveys by the Bureau of Labor Statistics in 1958–59 show the following average straight-time hourly earnings of industrial machinery repairmen employed in a wide variety of manufacturing and nonmanufacturing establishments in 15 large metropolitan areas:

Baltimore	$2.67
Boston	2.33
Buffalo	2.77
Dallas	2.32
Denver	2.60
Detroit	3.04
Los Angeles-Long Beach	2.75
Memphis	2.24
Minneapolis-St. Paul	2.53
Newark-Jersey City	2.76
New Orleans	2.57
Philadelphia	2.55
St. Louis	2.63
San Francisco-Oakland	2.92
Seattle	2.71

Industrial machinery repairmen are usually not affected by seasonal changes in production. During slack periods, when production workers may be laid off, repairmen are usually retained for maintenance jobs. Many companies also use machine repairmen to do major repair and overhaul jobs during periods of curtailed production.

Because motors and other parts of machines are not always readily accessible, maintenance mechanics may work in stooped or cramped positions close to the floor or from the tops of ladders. The use of protective slings, metal helmets, and other devices helps these workers to perform their jobs safely.

Most industrial machinery repairmen belong to unions. Some of the unions to which these workers belong are the United Steelworkers of America; the International Union of United Automobile, Aircraft & Agricultural Implement Workers of America; and the International Association of Machinists.

Instrument Repairmen

(D.O.T. 5-83.456, .971, and .972)

Nature of Work

Instrument repairmen install and keep in good operating condition the many thousands of instruments used in industry and the home. These instruments control or measure temperature, pressure, speed, altitude, or other physical characteristics. Some of the more common types of instruments are recording thermometers which measure variations in temperature, gyroscopic devices which aid in stabilizing aircraft and ships, and voltmeters and ammeters which measure characteristics of electricity.

The skills used by instrument repairmen (also called instrument servicemen or instrument technicians) vary widely because the instruments they service range from simple thermostats to very complicated instrumentation systems which control many manufacturing operations. American industry is becoming increasingly dependent upon instruments in many of its production and research activities. The recent trend toward the automation of manufacturing processes has greatly expanded the need for instruments and control devices and has resulted in increased employment in this small but growing occupation. (These craftsmen should not be confused with instrument makers or electronic servicemen or technicians. A detailed discussion of these occupations appears elsewhere in the Handbook. See index for page numbers.)

When repairing defective instruments, the instrument repairman may first check their accuracy with any one of many different types of testing equipment. For example, he may use a potentiometer (an instrument for measuring or comparing voltages) which is designed to help him diagnose trouble. He may disassemble the instrument, in order to replace worn or broken parts, or to rewire, straighten, or resolder inoperative or damaged parts. The instrument repairman may use schematic diagrams, assembly drawings, or blueprints as guides in repairing instruments. He may also make electrical tests to locate trouble in component parts or in electrical circuits. After the repair has been made, he reassembles the instrument and rechecks its operation with testing equipment. He also checks the accuracy of dial indicators on the instrument.

In addition to using many types of testing equipment, such as pressure and vacuum test gauges, and tachometer testers (speed counters), in order to detect causes of trouble, instrument repairmen also use simple handtools, such as

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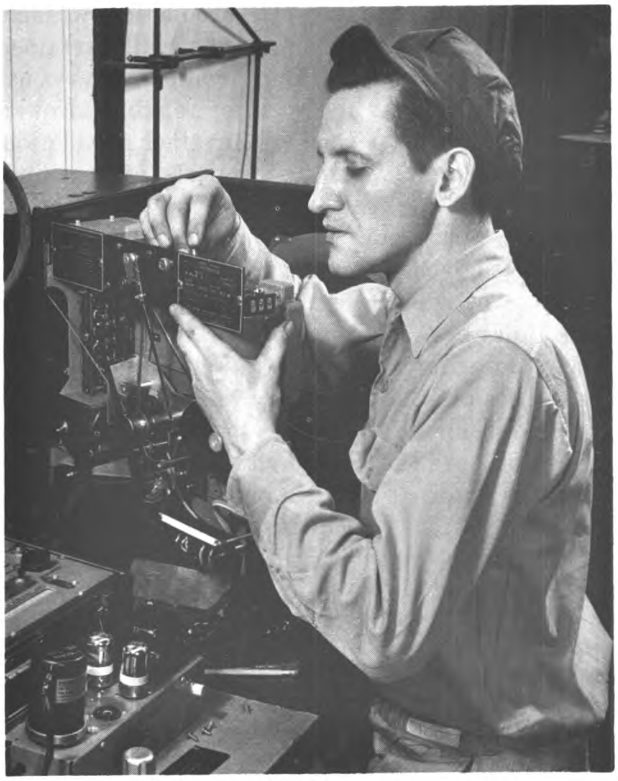


Instrument repairmen are becoming more important with the increasing use of instruments throughout our economy.

screwdrivers, wrenches, hammers, pliers, tweezers, soldering irons, files, and punches in their repair work.

In doing preventive maintenance work, the instrument repairman tries to detect defective instruments and repair them before they break down and cause production losses or inconvenience. The repairman doing maintenance work may visually inspect instruments for loose or broken parts, rust, jammed threads, or other defects. He may also regularly clean and lubricate the instrument and adjust it to keep it operating properly. Testing equipment is used by the repairman to be sure that the instruments are in good operating order. Part of his maintenance job may include the keeping of records to indicate the condition of the instruments being examined and a time table showing when servicing is to be performed.

When doing installation jobs, instrument servicemen employed by instrument manufacturers may advise customers as to the most advantageous placement of instruments. They also test instruments during initial operation and explain to the customer's own maintenance staff how the instruments operate and the care required.

Some instrument technicians are employed by instrument manufacturers to work with engineers in developmental and research work. These highly trained technicians may assist the research engineers by planning, laying out or modifying instruments and testing equipment for test purposes. They may convert or modify existing equipment according to new specifications or changes in design. Their work may involve the planning and estimating of time and material requirements and coordinating work between the engineering departments. (For additional information, refer to statement on Technicians. See index for page numbers.)

Where Employed

The two principal fields of employment of the approximately 50,000 instrument repairmen at work in 1958 were firms manufacturing engineering, laboratory, scientific, and optical instruments and mechanical measuring and controlling instruments; and gas and electric utilities. Substantial numbers were also employed by petroleum refineries, chemical, rubber, aircraft, missile, automobile, and electrical equipment manufacturers, and air lines. Instrument repairmen also work in such diverse places as steel mills, papermaking and food-processing plants, and liquor distilleries. In mid-1957, about 5,000 of these skilled repairmen were working for Air Force, Navy, and Army installations and for civilian government agencies.

Although instrument repairmen are employed in almost every large city, their jobs are concentrated in the main centers of instrument making, such as Boston, Chicago, Los Angeles, Minneapolis, New York City, Philadelphia, Rochester, St. Paul, and Washington, D.C.

Training, Other Qualifications, and Advancement

Most instrument repairmen learn their trade while working on the job. They are generally hired as trainees by instrument manufacturers or by other employers who use a considerable number of instruments in their manufacturing or processing operations. Some companies have formal programs for training their instrument repairmen; in other companies, new workers learn the trade by working with experienced specialists. Some companies with formal training programs offer their trainees specialized courses in instrumentation theory, mathematics, and blueprint reading in addition to practical training. These courses may be given during or after working hours by local schools.

A small number of instrument repairmen enter the occupation through apprenticeship programs. The apprenticeship program, which generally lasts about 4 years, includes some shopwork in the use of handtools and practical experience in the repair and maintenance of many types of instruments. The program also includes the classroom study of related technical subjects, such as mathematics, physics, electronics, chemistry, blueprint reading, and instrumentation theory.

Other men have trained for this field by attending technical institutes and junior colleges. These post-high-school educational institutions offer courses which generally last about 2 years. The courses include both manual training and classroom instruction in the basic principles of science. Because of the broad programs offered by these schools, their graduates are often able to obtain technician jobs as instrument servicemen or engineering assistants doing research and developmental work in instrument company laboratories.

Several instrument manufacturers offer specialized training to the skilled maintenance employees of the companies purchasing their products. These training courses last from 1 week to 9 months, depending upon the complexity of the instruments to be serviced. The men are instructed in design, theory, maintenance, and operation of instruments so that they can service the equipment after it has been installed in their employers' plants.

The Armed Forces technical schools also offer training in instrument servicing. Young men who expect to enter the Armed Forces, and who are interested in this field of work, would do well to investigate the opportunities for training and work experience in the instrument field available to persons in military service. The skills acquired in this trade in the Armed Forces are often transferable to civilian work.

The time required for acquiring the skills and technical knowledge of this occupation varies considerably depending upon such factors as the complexity of the instruments being serviced and the intensity of the training. Many companies have programs which last from 2 to 3 or more years. Some training authorities estimate that 4 to 5 years of training and experience are necessary in order to become a topflight instrument specialist. Some employers reduce on-the-job or apprenticeship training time if their employees attend the intensive courses given by instrument manufacturers.

Trainees as well as apprentice applicants generally must have a high school education or its equivalent. Courses in mathematics, physics, chemistry, electricity, electronics, machine shop practice, and blueprint reading are considered useful preparation for these jobs. Some employers give applicants tests to determine their mechanical aptitude and manual dexterity. If the applicants are to be employed in service branches where they will meet the public, they are expected to be neat in appearance and have the ability to get along with people.

Well-trained and qualified instrument repairmen may advance to positions of increasing responsibility as they acquire additional skill, knowledge, and experience. They can become group leaders or foremen in maintenance departments. They may also advance to jobs as service representatives in branch offices of instrument manufacturing companies. Some instrument repairmen may eventually become engineering assistants in the engineering departments of instrument companies. With the increasing use of electronic components in instruments and control equipment, young men who hope to advance in the field of instrument servicing are advised to acquire a basic knowledge of electronics theory and principles.

Employment Outlook

The number of instrument repairman jobs is expected to increase at a faster rate than the labor force as a whole during the 1960's. The increasing dependence on instruments and control equipment by industry, commercial establishments, and in homes in the next decade should accelerate the demand for skilled workers who can install, repair, and maintain these devices.

The use of instruments has expanded rapidly in the postwar period. Between 1947 and 1954, the value of shipments of the scientific, mechanical measuring, and optical instrument industries increased by 92 percent. The petroleum, rubber, paper, aircraft, and food-processing industries have been especially important in creating this increased demand for instruments.

In the future, continued growth in the use of instruments is expected. The industries already important as users of instruments will require increasing quantities of control and measuring devices as they develop more automatic processes. In addition, the increasing emphasis upon automatic production and continuous material flow in the automobile and other metal working industries will require more instruments and complex controls. The anticipated increase in research activities in biology and medicine, chemistry, physics, meteorology, astronomy, and other fields will contribute to the growing demand for scientific instruments. The more widespread application of atomic energy will require complex measuring and control systems, and a rapid acceleration in satellite and missile work would also expand the demand for instruments.

The increasing complexity of instruments as well as the growth in the number of instruments in use will affect not only the employment opportunities but the skill level of instrument repairmen. Employment will increase considerably, and workers with the best training in the fundamentals of mathematics, science, and instrumentation will be most in demand in this small occupation.

The vital function of instruments in manufacturing and processing operations makes their maintenance important in automatic and highly integrated production systems. More emphasis is being placed upon preventive maintenance today. A continuation of this trend will require the employment of increasing numbers of instrument repairmen.

Earnings and Working Conditions

In general, the earnings of instrument repairmen compare favorably with the earnings of other skilled maintenance workers. Information collected from a small number of petroleum refineries showed that their instrument mechanics were earning from about $2.90 to $3.10 an hour in early 1958. In the steel industry, these skilled craftsmen were receiving an hourly rate ranging from $2.62 to $2.88 an hour during the same period. Instrument repairmen were earning between $2.50 and $2.95 an hour in some West Coast aircraft manufacturing establishments in early 1958. Some highly skilled instrument repairmen employed as service representatives by instrument manufacturers were earning from about $3.10 to $4 an hour during the same period.

Instrument repairmen employed by the Federal Government are paid the prevailing rate for the occupation in a particular location. Thus, in early 1958, the hourly wage rates for these workers employed by the Government in the Washington, D.C., area ranged from $2.50 to $2.70, which were the same as the rates for those employed in private industry in the area.

The work environment of the instrument repairman depends largely on his particular assignment. In a single day, for example, a repairman may spend part of the day servicing instruments on the factory floor amid the noise, oil, and grease of machinery; and part of the time working at a bench in a quiet, clean, well-lighted repair shop. An instrument repairman employed by an instrument manufacturer as a serviceman may do considerable traveling within the area serviced by his employer.

Most instrument repairmen work a 40-hour, 5-day week. However, those employed in petroleum refineries and chemical plants which operate 24 hours a day and 7 days a week may work on any one of the three shifts—often on a rotating basis. They may also be part of an emergency crew which may be called on for Sunday and holiday work. Premium pay is generally paid for night and holiday work. Most of the companies which employ instrument repairmen provide paid holidays and paid vacations. Many of these specialists may also receive benefits, such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and a retirement pension.

Instrument repairmen may be members of one of several unions, depending upon the industry in which they are employed. Among the unions to which these craftsmen belong are the International Brotherhood of Electrical Workers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the International Association of Machinists; and the International Brotherhood of Pulp, Sulphite and Paper Mill Workers.

Where To Go for More Information

For more information on job opportunities, training, and other questions write to:

Foundation for Instrumentation Education and Research, Inc.,
527 Lexington Ave., New York 17, N.Y.

Instrument Society of America,
313 Sixth Ave., Pittsburgh 22, Pa.

For positions with the Federal Government, inquiries should be made at the regional offices of the U.S. Civil Service Commission.

Jewelers and Jewelry Repairmen

(D.O.T. 4–71.010, .020, and .025)

Nature of Work

Jewelers are skilled workers who make and repair rings, pins, earrings, bracelets, and other jewelry. They work with small handtools such as drills, saws, files, and soldering irons; they also use jewelers' lathes and other machines to reshape old jewelry or make new jewelry. Jewelry craftsmen work with platinum, gold, silver, or other metals and with precious, semiprecious, or synthetic stones. Repair work includes making rings larger or smaller, soldering broken parts, and resetting stones.

Most precious jewelry is made by hand. The operations involved include preparing molds and dies according to design, casting metals, and placing gems in settings. As a rule, hand jewelers specialize in making a particular kind of jewelry; only after years of experience do some become all-round jewelers capable of making and repairing almost any kind of jewelry.

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Skilled jewelry worker setting a diamond.

Costume and other less expensive kinds of jewelry are usually mass produced by factory workers using assembly-line methods to make the finished product. Large manufacturing establishments producing inexpensive jewelry generally employ only a few highly skilled jewelers who perform a limited number of operations such as making jewelry models or tools.

Retail jewelers are primarily businessmen who buy and sell diamonds, watches, silverware, glassware, electrical appliances, and other merchandise. Although many retail jewelers are skilled craftsmen, an increasing number of the newer retail jewelry stores are owned or operated by merchants who are not jewelers. When repair work is brought to these merchants, they estimate the cost and then send the articles to a trade shop or back to the manufacturer for repairs.

Where Employed

Most jewelers and jewelry repairmen work in retail jewelry stores, either as owners or employees, or in trade shops which serve these stores. Some are employed in jewelry manufacturing establishments; a few work for department stores and wholesale jewelry firms. Information on the exact number of jewelers and jewelry repairmen is not available. Furthermore, the functions of jewelry repairmen and watch repairmen overlap, and it is difficult to separate the two occupations. Jewelers were not reported separately by the Census Bureau in 1950 but were included in a combined total of about 45,000 employed jewelers, watchmakers, goldsmiths, and silversmiths. (For a discussion of watch repairmen, see p. 383.)

As a rule, each employer has only a few skilled jewelers. Many retail jewelry stores and trade shops employ only one or two skilled men. Precious jewelry also is generally manufactured in small shops, and even the few large establishments that manufacture costume jewelry are likely to employ only a limited number of trained jewelry craftsmen.

Although many small towns have at least one store which sells and repairs jewelry, most of the Nation's 25,000 retail jewelry stores, as well as the trade shops which service these stores, are located in and near large cities. Precious jewelry manufacturing is concentrated chiefly in the New York metropolitan area; the Providence, R.I., area ranks next in importance. In 1954, three-fourths of the 1,327 precious jewelry manufacturing plants were located in New York, Rhode Island, New Jersey, Massachusetts, and Pennsylvania.

Training and Other Qualifications

Young persons generally learn the jewelry trade either by serving a formal apprenticeship or through informal on-the-job training while working for an experienced jeweler. Jewelry repair, which is usually less complicated than jewelry making, can be learned in a short time by individuals already trained in filing, sawing, drilling, and other basic mechanical skills. Courses in jewelry repair are sometimes given in those trade schools which teach watchmaking and watch repairing.

Opportunities for obtaining on-the-job training are not widespread in this trade. Only a few of the larger shops are able to undertake formal apprenticeship training. Depending upon the specialty to be learned, the apprenticeship period ranges from 2 to 4 years; for example, it takes 3 years to become a stone setter and 4 years to qualify as a diamond setter. During each year of the apprenticeship, training on the job is supplemented by trade school instruction in design, quality of precious stones, the chemistry of metals, and other related subjects. The apprentice may begin as a charger, setting up the work for soldering, or he may do simple soldering or rough polishing. As he gains experience, he advances to more difficult work. On completion of the apprenticeship, he becomes a journeyman jeweler.

High school education is desirable for young people seeking to enter the trade. Courses in chemistry, physics, mechanical drawing, and art are particularly useful. Personal qualifications important for success in this field are mechanical aptitude, finger and hand dexterity, artistic ability, and good eyesight. For those planning to become retail jewelers, the ability to deal with people and manage a business is also important.

Employment Outlook

Skilled all-round jewelers with artistic talent and mechanical ability will probably be able to find employment readily during the early 1960's. Specialized jewelry craftsmen, such as stone setters and modelmakers, will also have favorable employment prospects, especially in manufacturing shops. However, beginning jewelers and those trained only in repair work may encounter difficulty in finding desirable employment. Opportunities to learn the trade through formal apprenticeship or informal on-the-job training are expected to remain limited.

Men planning to open their own jewelry stores should expect to face considerable competition in most parts of the country and should be prepared to make a substantial investment. As in the past, retail jewelers who can also repair watches will have an advantage over those who can work on jewelry only, especially in the smaller cities and towns. It should be borne in mind that this is a luxury trade and any downturn in general levels of business activity would adversely affect employment opportunities and incomes of jewelers.

In the long run, little expansion from current levels of employment of skilled jewelers and jewelry repairmen is expected in either jewelry manufacturing or retail trade. The anticipated growth in the number of retail jewelry stores is not likely to result in a comparable increase in employment of jewelers since many of the new stores will not be owned or managed by skilled jewelers. Most openings for skilled jewelers will arise through turnover and from the need to replace those who retire from the trade or die. However, such openings are expected to be relatively few because the field is a small one and because jewelers traditionally work at the trade well beyond the normal retirement age, provided they retain good eyesight and steady hands.

Earnings and Working Conditions

The earnings of jewelers engaged in retail trade follow closely the fluctuations in retail jewelry sales. Earnings are usually highest in the Christmas season and lowest during the summer. The size and location of the store also affect the incomes of retail jewelers.

More than three-fourths of the skilled jewelry workers employed by precious jewelry manufacturers in the New York City area are covered by a union contract. This agreement is between their employers and the International Jewelry Workers' Union—the major union in the field. In 1958, the agreement provided that apprentices were to start at $1.15 an hour and receive an increase every 3 months until they reach the applicable minimum rate for journeymen. The minimum journeymen rates were $2.20 for stone setters, $2.35 for all-round jewelers on handmade work, and $2.60 for modelmakers and diamond setters.

Skilled workers in the precious jewelry manufacturing shops of the New York City area have a 35-hour workweek and are paid time and one-half for all work done before or after the regular workday. On the other hand, retail jewelers and jewelry repairmen regularly work longer hours. In addition, they may do a considerable amount of overtime work, especially during the Christmas season.

Maintenance Electricians

(D.O.T. 4–97.420)

Nature of Work

Maintenance electricians (electrical repairmen) are skilled craftsmen who are responsible for the efficient operation of motors, transformers, generators, and other electrical equipment used in manufacturing and commercial establishments. A large part of the maintenance electrician's work consists of detecting and repairing defective equipment to prevent electrical breakdowns. When trouble does develop, the electrician must quickly find and repair the faulty wiring or equipment in order to prevent production losses and inconvenience.

In the course of his daily work, the maintenance electrician performs many different jobs. For example, he may install new electrical equipment or he may make repairs by replacing wires, fuses, transformers, or switchboards. While doing repair or installation work, the electrician may link wires by splicing or by using mechanical connectors. He may also measure, cut, bend, and install conduits through which wires are run to outlets, panels, and boxes.

In testing electrical equipment and wiring, the maintenance electrician uses such devices as ammeters, voltmeters, and test lamps. He sometimes works from blueprints and other specifications when doing repair or installation jobs. He may make mathematical computations relating to load capacities of electrical wiring. The many different tasks performed by a maintenance electrician call for the use of a large variety of handtools such as wrenches, screwdrivers, hacksaws, and pipe bending and threading tools.

Although all these craftsmen use the same tools and possess the same basic skills, the nature

Maintenance electrician checking wiring of a machine which controls a manufacturing process.

of their work depends in large part on the particular industry in which they are employed. The maintenance electrician in manufacturing plants usually repairs or maintains the electrical equipment operated in connection with the production of a specific item. For example, a steel mill requires a large number of electricians to keep its rolling mills, heavy cranes, and other electrical equipment in good working order. In large office buildings or apartment houses, skilled electricians are needed to maintain wiring, motors, and compressors used in the operation of elevators, refrigerators, lights, and other electrical equipment and fixtures.

Where Employed

An estimated 185,000 maintenance electricians were employed throughout the country in 1958. Approximately 80,000 of these craftsmen were engaged in servicing the equipment and machinery used in manufacturing plants. About 16,000 of these workers were employed by manufacturers of primary metal products; 12,000 in factories producing transportation equipment; 11,000 in chemical and allied products plants; 7,000 in factories producing nonelectrical machinery; 5,000 in plants producing paper and allied products; and the remainder were widely distributed among the other manufacturing industries.

Of the more than 100,000 maintenance electricians working in nonmanufacturing establishments in 1958, about 41,000 were working in retail and service enterprises; State and Federal Governments employed another 35,000; 7,000 were employed by railroads; 5,000 by wholesale trade establishments; and approximately 8,000 were employed in maintaining and repairing the electrical equipment of mines. Other nonmanufacturing establishments employed the balance of these skilled workers.

Although the jobs of maintenance electricians are widely distributed throughout the United States, the largest number of these workers are employed in those States which are heavily industrialized and which have the greatest concentration of population. In 1958, over 40 percent worked in five States—New York, California, Pennsylvania, Illinois, and Ohio.

The fact that maintenance electrician jobs are located in almost every city and town throughout the Nation is an important consideration for many young people since the choice of an occupational field is frequently limited by ties of home, family, and friends. Prospects of being employed near home are much better in this field than in many other skilled occupations. Skilled workers in this trade also have the advantage of being able to transfer to different industries. They may also be able to transfer into construction electrician jobs with some retraining.

Training and Other Qualifications

Maintenance electricians can learn the skills of their trade through formal apprenticeship programs, by informal on-the-job training, or by accumulating experience through a series of jobs in their trade. Training authorities generally agree that apprenticeship programs give the worker more thorough preparation, a broader background, and greater job mobility in his future working life.

The apprentice program for maintenance electrician usually lasts about 4 years. Apprentices are given on-the-job training and related technical classroom instruction in such subjects as drafting, mathematics, and electrical theory. On-the-job training may include motor repair; wire splicing; commercial and industrial wiring; installation of light and power equipment; electronic controls and circuits; and welding, brazing, and burning.

A young man employed in a small plant may learn his job by working as a helper to a skilled craftsman. By observing the skilled journeyman and receiving instruction from him, the helper gradually acquires the skills of his trade. Other electricians learn the trade by working in the maintenance department of a plant and picking up some of the fundamentals of the electrician's job. By moving from job to job, they acquire sufficient experience so that they are eventually hired as journeymen electricians.

A young man interested in becoming a maintenance electrician should include courses in physics, mathematics, and shopwork in his high school or vocational school curriculum. Because the electrical field is subject to constant change, many experienced electricians must continue to learn new skills in order to do their job. For example, some maintenance electricians who entered the trade some time ago now must learn basic electronics in order to service the new electronics equipment being introduced in the Nation's factories and large residential and commercial buildings.

In selecting apprentice applicants or trainees, employers look for young men who have manual dexterity and who are interested in learning how electrical equipment functions. Although great physical strength is not essential, agility and good health are important.

Employment Outlook

A substantial increase in the number of maintenance electrician jobs is expected in the next decade. The anticipated industrial growth of the country and the long-term trend in the increased use of electrical equipment should provide favorable employment prospects for these skilled craftsmen.

As the amount of electrical equipment and facilities in use has expanded, the maintenance electrician occupation has grown from a few thousand workers at the turn of the century to an estimated 185,000 in 1958. Electric power production has doubled every 10 years since 1900 and it is expected to double again in the next decade. About half of the electric power generated today is consumed by industrial concerns, and a considerable portion of the remainder is used in large office, hotel, and apartment buildings. With well over half of the electricity being used in establishments which employ maintenance electricians, it can be expected that the anticipated expansion in electrical power production will result in increased employment of these workers.

The maintenance electrician occupation is one which also will be favorably affected by the trend toward the use of electric and electronics devices in automatic manufacturing processes.

In addition to the new job openings which are expected to develop as a result of industrial expansion and the increased use of electrical equipment, many new workers will be needed to replace the workers who retire, die, or transfer to other fields of work. Retirements and deaths alone may result in about 3,500 to 4,500 new job openings a year during the 1960's.

Earnings and Working Conditions

In general, the earnings of maintenance electricians compare favorably with those of other skilled craftsmen. The following table, based upon 1958–59 wage surveys made by the Bureau of Labor Statistics indicates the average straight-time hourly earnings of maintenance electricians in 15 large city areas:

Baltimore	$2.62
Boston	2.58
Buffalo	2.86
Dallas	2.32
Denver	2.67
Detroit	3.07
Los Angeles-Long Beach	2.97
Memphis	2.53
Minneapolis-St. Paul	2.89
Newark-Jersey City	2.87
New Orleans	2.69
Philadelphia	2.69
St. Louis	2.91
San Francisco-Oakland	3.04
Seattle	2.81

The work environment of the maintenance electrician varies greatly from job to job. In the course of a single day, an electrician employed in a plant may repair electrical equipment both in a clean air-conditioned office and on the factory floor amidst the noise, oil, and grease of machinery. In order to install or replace electrical equipment, pull cable, and perform other repair jobs, maintenance electricians may sometimes be called upon to climb ladders, work on scaffolds, or work in awkward or cramped positions.

Because they often work around high voltage industrial equipment, maintenance electricians must be alert and accurate in carrying out their duties. Errors in wiring installations could have dangerous consequences to the electrician as well as to the operating employees. The safety principles which are now part of all training programs have greatly reduced the frequency of accidents. All well-trained maintenance electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to handle small electrical fires.

Various unions have organized maintenance electricians. Many of these craftsmen are members of the International Brotherhood of Electrical Workers. Among other unions to which maintenance electricians belong are the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and the United Steelworkers of America.

Where To Go for More Information

The National Joint Apprenticeship and Training Committee for the Electrical Industry,
1200 18th St. NW., Washington 6, D.C.

The State Supervisor of Trade and Industrial Education or the Local Director of Vocational Education in the State and/or city in which a person wishes to receive training will have lists of training institutions.

Millwrights

(D.O.T. 5–78.100)

Nature of Work

Millwrights are skilled workers whose principal job is to move and install machinery and other heavy equipment used in industry. They must know the structure and operation of the equipment on which they work because, after dismantling and moving machines, they must also reassemble them at the new site. In doing this work, they fit bearings, aline gears and wheels, connect belts, and attach motors. They often work from blueprints when preparing platforms on which machines are to be mounted or when laying out or installing plant equipment and machinery.

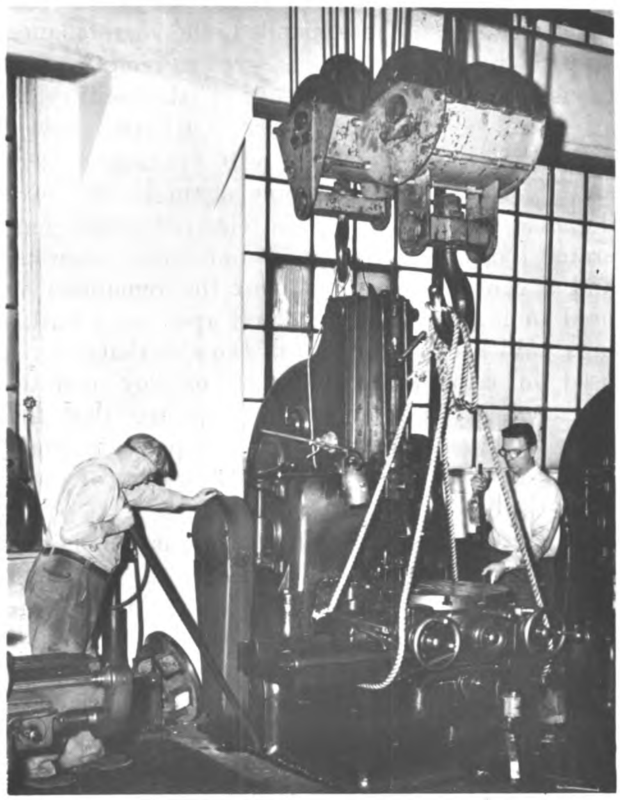
Millwrights use hoists, cranes, jacks, crowbars, wooden blocking, and other rigging equipment to move heavy equipment. They use hammers, wrenches, screwdrivers, and other handtools in assembling machinery. When alining machinery, they may also use measuring devices such as micrometers and calipers.

In addition to installing, assembling, and disassembling machinery, millwrights often repair and maintain such equipment as conveyors, cranes, hoists, and balers. Their maintenance and repair duties may include the oiling and greasing of machinery, the replacement of worn or broken belts, and the welding of metal parts. Millwrights sometimes work as part of a maintenance team of pipefitters and machine repairmen in keeping an automatic production line in operating order.

Where Employed

Most millwrights are employed in those industries which use heavy machinery and equipment. The principal employers of the 75,000 millwrights at work in late 1958 were the automobile, iron and steel, machinery, woodworking, pulp and paper, and construction industries. The automobile and steel industries, which are particularly dependent upon massive equipment in their manufacturing operations, together employed about 21,000 of these skilled workers.

Other millwrights are employed by companies which specialize in the assembling, disassembling,



COURTESY OF U.S. NAVAL GUN FACTORY

Millwrights using crowbars to guide machine into position as it is lowered by hoists.

and moving of industrial machinery on a contract basis. Some also work for machinery manufacturers who employ millwrights to install their products in customers' plants.

Millwrights work in every State. However, about half of them are employed in the heavily industrialized States of Ohio, Michigan, Pennsylvania, New York, and Illinois.

Training and Other Qualifications

Workers enter this occupation through apprenticeship training programs or by picking up the skills informally. Those workers who pick up the trade, work as helpers to journeymen over a period of years until they acquire sufficient knowledge and experience to be classified as skilled workers. Most training authorities agree that apprenticeship programs give young persons a more thorough preparation for this skilled trade. Apprenticeship programs generally last 4 years. Apprentices are given shop training in dismantling, erecting, and repairing machinery and equipment. They are also trained in floor layout, the installation of machinery and electric motors, welding, and the erection of structural steel, plate steel, conveyors, and building beams. The apprenticeship program includes related classroom instruction in mathematics, general science, blueprint reading, hydraulics, and electricity. Many companies prefer that apprentice applicants be high school graduates between the ages of 18 and 26.

High school courses in mathematics, mechanical drawing, and shop work will be useful to young persons interested in becoming millwrights. Because millwrights often assemble and disassemble complicated machinery, mechanical aptitude will be helpful to young men entering the trade. Strength and agility are other important qualifications for millwright work, which often requires considerable lifting and climbing.

Employment Outlook

This occupation will offer employment opportunities for many new workers during the 1960's. It is expected to expand at a faster rate than the Nation's labor force.

New plant and equipment expenditures by the industries employing millwrights are expected to contribute to an increase in the employment of these workers in the 1960–70 decade. The building of new plants, the addition of new machinery, new plant layouts, and the maintenance of increasing amounts of heavy and complex machinery and equipment will all require the skills of millwrights.

The trend toward mechanization (automation) which is taking place in American industry will also result in an increased demand for millwrights. The automobile industry is an example of an industry which is expected to further mechanize its machining and assembling operations. Millwrights will be needed in greater numbers in this industry to install, move, and maintain machine tools, presses, transfer equipment, conveyor systems, and mechanized assembly lines.

In addition to the new job openings which are expected to develop because of industrial expansion and increased mechanization, about 1,500 to 1,700 workers will be needed each year during the 1960's to replace the millwrights who retire or die. Replacement needs will also be created by those who shift to other lines of work.

Earnings and Working Conditions

The earnings of millwrights depend upon the city where they are employed as well as the type of business in which their employer is engaged. According to a fiscal 1958–59 survey by the Bureau of Labor Statistics, the average hourly earnings of millwrights employed in manufacturing industries in 12 large metropolitan areas ranged from \$2.44 in Boston to \$3.17 in the San Francisco–Oakland area. Average straight-time hourly earnings of millwrights employed in manufacturing plants in the areas studied were as follows:

Baltimore	\$2.61
Boston	2.44
Buffalo	2.77
Detroit	3.01
Los Angeles-Long Beach	2.91
Memphis	2.58
Minneapolis-St. Paul	2.72
Newark-Jersey City	2.77
Philadelphia	2.65
St. Louis	2.86
San Francisco-Oakland	3.17
Seattle	2.61

Millwrights employed by companies doing contract installation work and by construction companies usually earn more than those employed in manufacturing industries. For example, the union wage rate for millwrights employed by contract installation companies in Baltimore was about $3.20 an hour in mid-1958.

The union wage rates for millwrights working in the building trades in July 1958 ranged from $2.80 an hour in Charlotte to $3.80 an hour in Baltimore. The rate in Cincinnati was $3.73; in Pittsburgh, $3.68; and in the San Francisco–Oakland area, $3.53.

Millwrights employed in the automobile industry averaged $2.76 an hour in mid-1957.

The wage rates for apprentices generally start at approximately 50 percent of the skilled worker's rate and progress to the full rate by the end of the training period.

Millwrights employed by manufacturing companies often have more job stability than those working for construction companies or millwright companies which do work on a contract basis. Although the work of millwrights is not seasonal, the latter employees may have short periods of unemployment between jobs.

The work of millwrights occasionally involves certain hazards. For example, they work with hoists and cranes in moving heavy machinery and equipment and must often work on high ladders. They are also subject to the hazard of falling objects. In recent years, accidents have been reduced by the use of protective devices such as safety belts, metal hats, and shoes with metal toes.

Most millwrights belong to unions. Some of the more important unions to which these workers belong are the International Association of Machinists; United Brotherhood of Carpenters and Joiners of America; United Steelworkers of America; International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and International Brotherhood of Pulp, Sulphite and Paper Mill Workers.

Refrigeration and Air-Conditioning Mechanics

(D.O.T. 5–83.941)

Nature of Work

Refrigeration and air-conditioning equipment, which is used in theaters, food stores, restaurants, homes, factories, and office buildings, is installed and kept in good operating condition by refrigeration and air-conditioning mechanics. (This chapter does not discuss mechanics who work on railroad, truck, and marine refrigeration and air-conditioning equipment.)

In installing a new refrigeration or air-conditioning unit, the mechanic positions motors, condensers, and humidifiers according to design specifications. He assembles and connects piping and refrigerant lines and then connects the equipment to an electrical power source. He installs electrical controls and checks the voltage entering the motor. After completing the installation and connecting the recording and gaging devices, the mechanic starts the unit and tests it for proper performance and for leaks. He also adjusts the pumps, humidifiers, filters, and other components in order to obtain the most efficient performance. On large installation jobs, the mechanic must read and interpret blueprints or drawings. On small installations, he may have to prepare his own sketches and do simple layout work, such as measuring and cutting pipe.

Mechanics engaged in maintenance work regularly lubricate the machinery, replenish the refrigerant, adjust valves, and examine other parts of the unit in order to detect leaks and other defects before serious trouble develops. When refrigeration and air-conditioning equipment breaks down, the mechanic must diagnose the cause and make the necessary repairs. In looking for defects, he may disassemble a motor, removing such parts as springs and brushes. After the cause of the trouble has been located and the defective part repaired or replaced, the mechanic reassembles the unit. He also may make electrical repairs in connection with his work. The mechanic uses tools and equipment, such as electric drills, soldering torches, flaring tools, benders, hammers, screwdrivers, and pliers, and such testing devices as leak detectors and test lights.

Mechanic adjusting an air-conditioning unit.

Where Employed

A considerable number of these mechanics are employed in shops which specialize in the repair and maintenance of commercial, industrial, and home refrigeration and air-conditioning equipment. Others work for construction companies, refrigeration or air-conditioning equipment manufacturers, contractors, and dealers. Some are employed by department stores, hotels, restaurant chains, factories, and other establishments large enough to require full-time maintenance men. Many mechanics have opened their own shops specializing in the repair of this type of equipment.

Because of the widespread use of refrigeration and air-conditioning equipment, these workers are employed in all parts of the country. However, they are primarily employed in the large cities, where most of the large commercial and industrial establishments are located. New York, California, Illinois, Pennsylvania, and Texas lead in the employment of these workers.

Training and Other Qualifications

Many refrigeration and air-conditioning mechanics pick up the skills of their trade through on-the-job experience. They start as helpers and acquire their skills by working for several years with experienced craftsmen.

Apprenticeship training is another method of learning this trade. The apprenticeship programs, which generally last 4 or 5 years, include both practical experience and classroom instruction. Apprentices are given training in the installing and connecting of refrigeration equipment, gas lines, liquid lines, air control lines, and other kinds of piping. As their training progresses, they do layout and assembly work and are taught the planning aspects of the trade. Apprentices are given classroom instruction in mathematics, blueprint reading, compression refrigerating systems, heat transfer and insulation, electrical controls, and related subjects.

Employers prefer to hire high school graduates who have had courses in mathematics, mechanical drawing, and physics. Mathematical ability is an important qualification since workers in this trade are often required to make involved calculations in installing equipment. Mechanical aptitude and the ability to understand and work with electricity are other important qualifications.

Young persons interested in advancing to higher level air-conditioning and refrigeration technician jobs are frequently advised by training authorities to attend a technical institute. (Additional information about refrigeration and air-conditioning technicians appears in the chapter on technicians.) In these schools, students are taught to design and construct as well as to install, operate, maintain, and repair all types of refrigeration and air-conditioning equipment. They also take courses in electricity, mathematics, and mechanical drawing.

Although great strength is not essential, persons interested in entering this occupation should be in good physical condition because they are often required to lift and move some of the air-conditioning and refrigeration equipment.

Employment Outlook

The continued increase in the use of refrigeration and air-conditioning equipment in the Nation's factories, commercial buildings, and homes in the 1960's is expected to create a demand for thousands of additional mechanics who can install, maintain, and repair this type of equipment. The number of refrigeration and air-conditioning mechanics is expected to grow at a faster rate than the labor force as a whole. In addition to the increased number of jobs resulting from the growth of this occupation, many openings will arise when workers retire, die, or transfer to other fields of work.

The use of refrigeration as a means of preserving food and other perishable items has grown tremendously in recent years. An increasing number of food items are preserved by refrigeration from the time they are picked in the fields or produced in factories until they reach the consumers' homes. Refrigerated storage warehouses, freight cars, trucks, and display cases have become the principal means of preserving perishable food in transit and in stores. The number of home refrigerators in use has increased at a rapid rate in keeping with this trend.

Refrigeration is also becoming increasingly important as part of the production process in the manufacture of such products as synthetic rubber, oil, high test gasoline, medicine, and drugs. Refrigeration is used to hold the temperature of the raw materials of these products at certain levels during processing in order to control their consistency, brittleness, tensile strength, or other properties. A continued growth in the use of refrigeration in the 1960's is expected.

Air conditioning is becoming extremely important in industrial, commercial, and home use. Many manufacturers use air conditioning for the control of air temperatures and humidity and for the removal of dust from the air during the production process. Film, explosives, leather, paper, optical goods, ammunition, plastics, and electronics equipment are examples of products in which air conditioning is used at some time during the manufacturing process. The use of air conditioning in offices, stores, and places of entertainment is increasing. Air conditioning for the home also has had its greatest expansion in recent years, with more than a 4,000-percent increase in the production of room air conditioners between 1947 and 1956. The recent introduction of the heat pump, a combination cooling and heating unit for home use, is also expected to contribute to the growth of this occupation.

Earnings and Working Conditions

Although earnings data on a national scale are not available, the following wage information collected from a small number of employers in selected cities on the East Coast and the Midwest shows that the earnings of refrigeration and air-conditioning mechanics compare favorably with those of other service mechanics. The rates of pay for skilled mechanics sometimes differ according to the size of equipment they work on, the type of work performed, and the type of establishment by which they are employed. For example, in June 1958 in some establishments, journeymen engaged in maintenance and repair work on small equipment were receiving $2.75 to slightly more than $3 an hour; men working on equipment of higher horsepower were being paid about $3.50 an hour. Mechanics doing installation work generally were receiving $2.75 to more than $3.75 an hour in mid-1958. Refrigeration and air-conditioning mechanics working on commercial equipment generally received higher earnings than those employed on household equipment, even when the equipment was of the same size. Apprentices usually start at about 50 percent of the journeyman's hourly pay rate and receive increases each year, moving up to 75 to 90 percent of the journeyman's rate during the last year of their apprenticeship.

Although most employers try to maintain the same work force throughout the year, some mechanics may be laid off during the winter months. Most mechanics work a 40-hour week. However, during the summer months they must often work overtime or at irregular hours to prevent financial loss and the inconvenience which can result from a breakdown of refrigeration or air-conditioning equipment. Time and one-half is paid for overtime in most shops.

Mechanics are sometimes required to work at high levels while installing new equipment. They may also work in awkward or cramped positions in order to reach motors or other parts of the equipment they are repairing. Hazards in this trade include those associated with the handling of heavy equipment and the possibility of torch burns.

Many refrigeration and air-conditioning mechancis belong to labor unions. Some of these unions are the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; the International Brotherhood of Electrical Workers; and the Sheet Metal Workers' International Association.

Watch Repairmen

(D.O.T. 4–71.510)

Nature of Work

Watch repairmen or "watchmakers" chiefly repair and adjust watches but also work on clocks and other timepieces. Repairing a watch involves very precise and delicate work. The first step is to remove the works from the case and examine the different parts with the aid of a magnifying eyeglass. The repairman may then replace the mainspring, hairspring, balance and other wheels, or broken jewels, and adjust improperly fitted wheels and other parts. He may also clean and oil the parts, replace the dial, hands, watch crystal, and wristband. The use of mass-produced parts which are interchangeable has considerably reduced the need for making parts by hand. However, factory-made parts must sometimes be adjusted to a particular watch to insure a "true" fit. In their work, watch repairmen use small lathes and handtools such as tiny pliers and screwdrivers.

Watchmakers who own or work in retail jewelry stores frequently repair jewelry as well as watches and may sell watches, jewelry, silverware, and other items such as china and lamps. They may also hire and supervise salesclerks, other watch repairmen, jewelers, and engravers; arrange window displays; purchase goods to be sold; and handle other managerial duties.

Where Employed

Most watch repairmen work in retail jewelry stores or in separate watch repair shops, either as owners or as employees. Many are employed by department stores and mail order houses or operate watch repair concessions in such establishments. Others work for trade shops (not usually open to the public) which repair watches for retail stores. A number work for jeweled-watch factories and importing firms or teach in watch repair schools.

Watch repairing requires patience and mechanical skill.

The exact number of watch repairmen is unknown. Many of the functions of watch repairmen and jewelers overlap and it is difficult to separate these occupations. Furthermore, some people who are employed in other occupations do watch repairing on a part-time basis. According to the Census, a total of 45,000 jewelers, watchmakers, goldsmiths, and silversmiths were employed in 1950; it is estimated that at least half this number were engaged primarily in watch repairing.

Although watch repairmen work in all parts of the country, they are located chiefly in and near large cities. The greatest number of these workers are in the New York City area.

Training and Other Qualifications

A few States—Florida, Iowa, Indiana, Kentucky, Louisiana, Minnesota, Oregon, Tennessee, and Wisconsin—require that watch repairmen obtain a license to work at the trade. Watch repairmen in these States must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair. However, watchmakers in all States can demonstrate their ability by passing an examination given by either the Horological Institute of America or the United Horological Association of America. The certificates awarded watchmakers who pass these examinations are widely recognized by employers as indications of acceptable standards of skill.

Many young people prepare for this trade through courses given in private watch repair schools. Some enter through vocational high school training. Others are trained in formal apprenticeship or other on-the-job training programs.

Less than 50 watch repair schools were in operation in 1958. These schools generally had no specific educational requirements for entrance although most students were high school graduates. The length of time required to complete the course—usually 18 months to 2 years—is determined by its content, the ability of the individual student, and whether attendance is full- or part-time. In most watch repair schools, a considerable amount of time is spent taking various types of watch movements apart and reassembling them, truing hairsprings, removing and replacing balance staffs and balance wheels, learning how to use a watchmaker's lathe, and cleaning watches. Some schools offer courses in the repair of unusual types of timepieces, for example, chronographs and new-type electric wristwatches. Students are required to furnish their own tools.

Important qualifications for success in this field are mechanical aptitude, finger dexterity, a sensitive touch, good vision (with or without glasses), patience, and pride in good workmanship. For those interested in owning or working in a retail store, salesmanship and a good business sense are desirable.

Most beginners work in retail jewelry stores where they can get the experience needed to reach a high rate of output. Those with sufficient funds—about $1,000 to $1,500 is needed to cover the cost of a watch-timing machine and other tools and equipment—may open their own watch repair shops. Some watch repairmen gradually extend their services to include the sale of various items of jewelry and eventually establish retail jewelry stores.

Employment Outlook

Employment opportunities will continue good in the early 1960's for experienced watch repairmen who have established reputations for doing high quality work. However, jobs for beginners are likely to be somewhat limited. Most openings will arise from the need to replace repairmen who retire, die, or transfer to other fields of work. A few new jobs will become available, particularly in small cities where business activities are expanding and in newly established shopping centers located in the suburbs of large cities. In addition, inexperienced watchmakers as well as other persons with the qualifications important in watch repairing will be in growing demand to work on miniature devices, especially in industries producing electronic equipment.

Over the long run, little expansion in employment of watchmakers is likely. Factors which will tend to increase the demand for watchmakers appear to be offset by other factors which will operate to decrease it. The number of watches in use will undoubtedly rise as population increases. In addition, the trends toward owning more than one watch, wearing watches as costume jewelry, and buying more children's watches are expected to continue. The popularity of small watches, which need repair more frequently than large ones, and the introduction of more complicated timepieces — chronographs, calendar watches, and self-winding watches—will also help maintain a large volume of repair work. On the other hand, sales of inexpensive watches which can be replaced at a price as low as the cost of repairing them will probably continue to grow; competition from persons employed in other fields who repair watches in their spare time is expected to continue; and new types of watches are being developed which will require less repair.

Earnings and Working Conditions

Salaries of most beginning watchmakers ranged from about $60 to $75 a week in 1958 depending on individual ability and the type and place of employment. Experienced watchmakers employed in retail stores generally received from $85 to $100 for a 40-hour week. Watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. However, earnings of those who are self-employed vary greatly, depending on the amount of repair work to be done, and, in the case of watchmakers who own retail jewelry stores, the volume of sales.

Watchmakers frequently work longer than the standard 40-hour workweek. Those who are self-employed or work in small communities usually work a 48-hour week or longer. Although there may be some tendency toward eye strain, the work involves little physical exertion. This light, sedentary work is frequently recommended to certain handicapped and disabled workers.

Where To Go for More Information

Information on schools giving training courses acceptable to the trade, as well as on watch repairing as a career, may be obtained from:

Horological Institute of America, State Life Bldg., 15 East Washington St., Indianapolis 4, Ind.

United Horological Association of America, Inc., 1901 East Colfax Ave., Denver 6, Colo.

506397 O—59——26

MACHINING OCCUPATIONS

Almost every item produced by American industry contains metal parts or is manufactured by machines made of metal parts. Most of these metal parts are made to precise dimensions by a group of key craftsmen known as machining workers. These workers use stationary power-driven machines known as machine tools to form metal to desired shapes and sizes. Machining is the most common method of producing metal parts to specified sizes. It is one of the five principal methods of shaping metal. The others are casting, forging, rolling, and stamping.

Machining workers make up the largest occupational group in the metalworking trades. Their special skills make them one of the most important groups of craftsmen in our labor force. In late 1958, more than a million workers were employed in the skilled and semiskilled machining occupations as all-round machinists, tool and die makers, instrument makers, machine tool operators, setup men, and layout men.

Nature of Work

The principal job of metal machining workers is to operate machine tools. A machine tool is a power-driven machine which firmly holds both the piece of metal to be shaped and a cutting instrument, or "tool," and brings them together so that the metal is cut, shaved, ground, or drilled. In some cases, the cutting tool is moved and the metal is held stationary; in others, the metal is moved against a stationary tool. The most common types of machine tools are: lathes, grinding machines, boring mills, drilling machines, milling and broaching machines, shapers, and planers. The lathe is a machine in which the piece of metal, while revolving on a spindle, is cut to size by contact with a sharp metal cutting tool. Grinding machines are used to remove metal from internal and external surfaces by means of power-driven abrasive wheels. Boring mills and drilling machines are used to make holes in metal. Milling and broaching machines shape and remove metal with multiple cutting edge tools. Shapers and planers are machine tools which produce flat surfaces.

Accuracy is of prime importance for most metal machining work. Machines, engines, and other metal products are made of separate metal parts which must be made to precise dimensions by machining processes so that they are interchangeable and can be easily assembled for mass-production purposes. Metal parts sometimes are machined to dimensions equal to about one-thirtieth the size of a human hair or one ten-thousandths of an inch (0.0001). Directions to machining workers generally are given in the form of a drawing or blueprint upon which exact dimensions of the finished part are specified; some instructions may be less detailed. Machining workers frequently use a precision-measuring instrument known as a micrometer or "mike" to check the accuracy of their work against specifications.

In addition to the operation of machine tools, the skilled tool and die makers, instrument makers, machinists, and layout men spend a considerable portion of their time doing precision handwork such as laying out and assembling metal parts. After the separate parts have been machined, they use chisels, scrapers, and other small handtools in chipping, filing, and polishing the parts for exact fit in the final assembly.

The all-round machinist is a skilled worker who can operate most types of machine tools. A highly skilled machining job is that of the tool and die maker who specializes in making dies for use with presses and die casting machines, devices to guide drills into the metal, and special gages to determine whether the work meets specified tolerances. Another highly skilled machining job is that of the instrument maker who constructs instruments, machining the metal parts and assembling and testing the finished instrument.

The largest number of machining workers are the skilled and semiskilled machine tool operators who run lathes, drilling machines, milling machines, grinders, and other machine tools. Setup men and layout men are skilled specialized workers employed in plants which produce large amounts of metal items. Setup men adjust machine tools so that semiskilled machine tool operators can run the machine and perform the proper machining operations. Layout men mark machining directions on metal so that an operator can perform the proper machining operations. A detailed discussion of the types of work performed by workers in each of these machining occupations is presented later in this chapter.

Since continuous attention is required when machine tools are in operation, the work may be rather tedious, especially on simple and repetitive machining jobs. However, where the work is varied and complex, and standards of accuracy are high, a worker can experience the satisfaction which comes to a capable and conscientious craftsman in a highly skilled trade.

Location of Machining Work

An estimated 600,000 machine tool operators, 265,000 machinists, 135,000 tool and die makers, 30,000 instrument makers, and 45,000 setup men and layout men were employed in machining jobs in late 1958. About two-thirds of these workers were employed in the metalworking industries, mostly in plants which manufacture machinery, transportation equipment such as automobiles and aircraft, fabricated metal products, and electrical machinery and equipment. (See chart 28.)

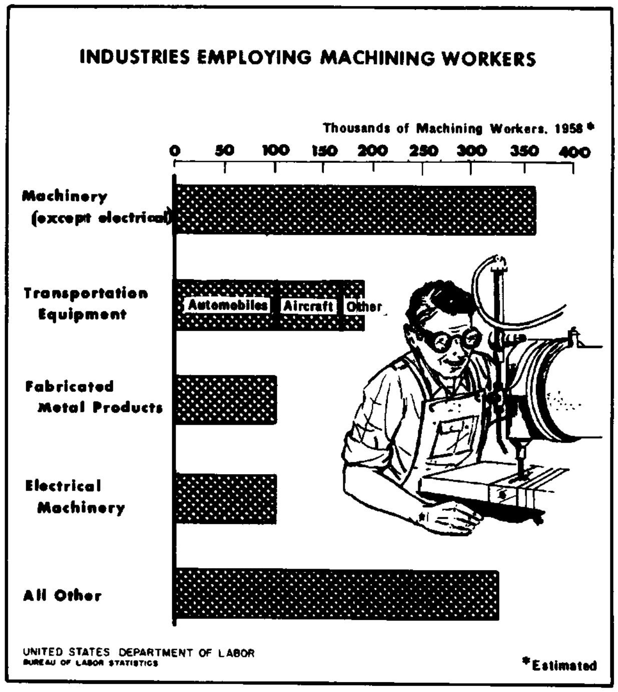
The remainder were employed mainly in nonmetalworking establishments such as the repair shops of railroads and the maintenance shops of factories which make textiles, paper, glass, and chemicals. Although the number of machining workers in individual nonmetalworking plants is relatively small, these plants as a group are an important source of employment.

Machine tool operators, tool and die makers, and all-round machinists are employed in every State and in almost every city in the country. More than half of the machining workers are employed in Ohio, New York, Illinois, California, Michigan, and Pennsylvania. (See chart 29.)

Training, Other Qualifications, and Advancement

Except for the semiskilled machine tool operating jobs, the common method of entering these occupations is through apprenticeship. The apprenticeship is a period of formal on-the-job

CHART 28

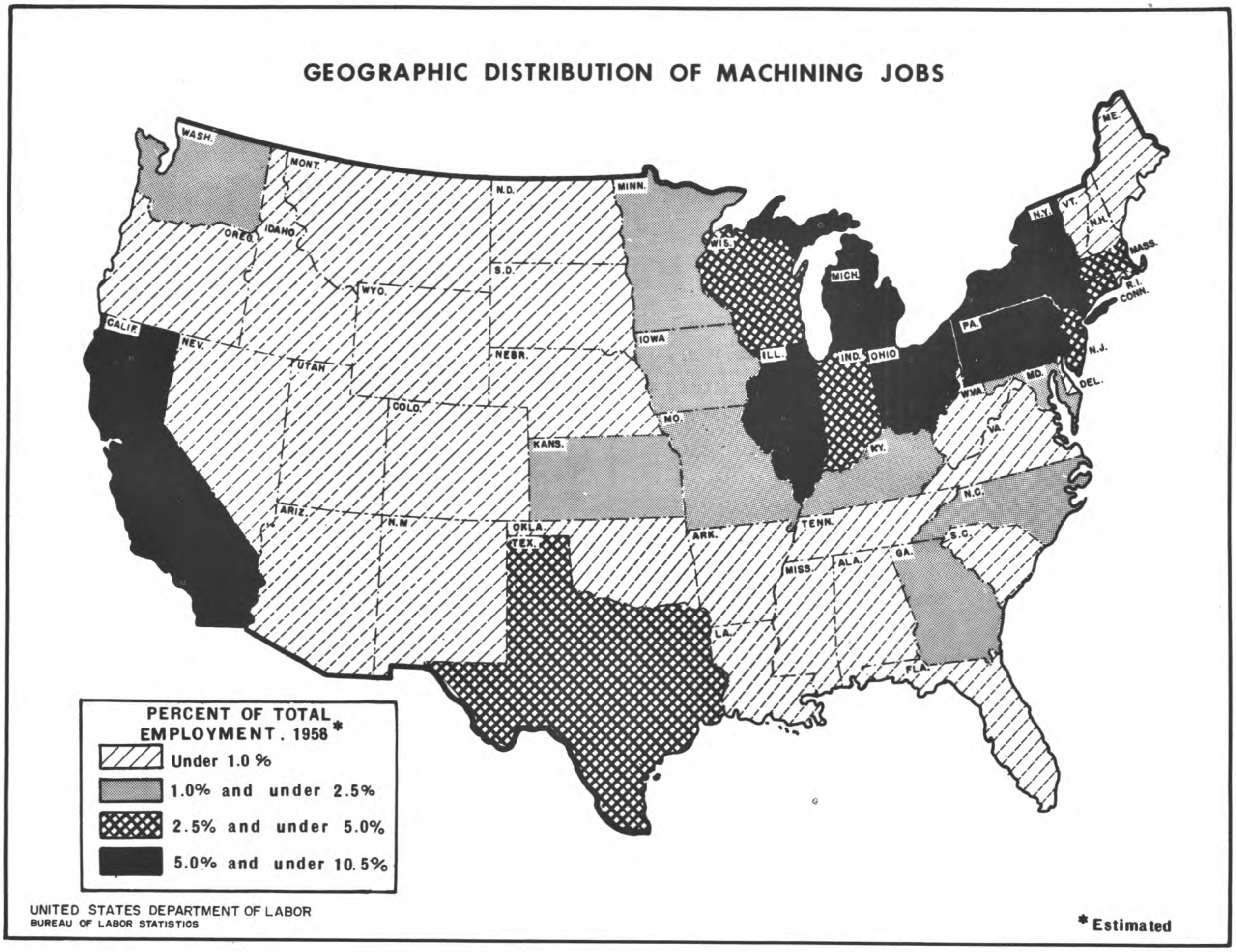


training during which the new worker learns all the aspects of his trade. He is taught how to operate machine tools, and how to use handtools and measuring instruments. In addition to shop training, the apprentice is given classroom instruction in blueprint reading, mathematics, and other related subjects. In choosing apprentices, employers usually prefer young men who have a high school or trade school education. Some companies use aptitude tests to determine whether applicants for their apprenticeship programs have the necessary mechanical ability and the temperament suited to perform exacting work.

Most machine tool operators and some machinists, tool and die makers, and instrument makers have picked up the skills of their trade informally through experience on the job. They generally start in the less skilled machine tool jobs and gain "know-how" while working with experienced craftsmen. They advance to the more skilled jobs after they acquire sufficient experience and knowledge. Some of these workers have helped to qualify themselves for the more skilled trades by taking courses in blueprint reading and shop mathematics in vocational schools.

Because the work is not physically strenuous, women are sometimes employed as machine tool

CHART 29



operators. For the most part, they are employed in the less skilled machining operations; there are practically none employed as tool and die makers, instrument makers, or all-round machinists, and relatively few work as skilled machine tool operators.

There are several advancement opportunities for workers in these occupations. For example, skilled machining workers are able to advance to positions as foremen. Some skilled machining workers are able to move into administrative jobs in metalworking establishments. Some tool and die makers and instrument makers can advance to positions as tool designers and other technical jobs. Another area of opportunity available to skilled machining workers is the possibility of opening their own tool and die establishments or machine shops.

Employment Outlook

There will be thousands of opportunities for new workers to get jobs as tool and die makers, all-round machinists, instrument makers, machine tool operators, layout men, and setup men in the 1960's. During this period, the number of workers employed in machining jobs is expected to rise significantly above the average level of employment in late 1958 of more than a million. A large proportion of job openings will result from the need to replace workers who retire, die, or transfer to other fields of work.

Despite fluctuations caused by changing business conditions, the long-range trend of employment in the metalworking industries has been upward. In recent years, employment of production workers in the metalworking industries, in which the majority of the machining workers are employed, has increased at a faster rate than production-worker employment in all manufacturing industries. Between 1947 and 1957, the average employment of production workers in the metalworking industries increased 16 percent as compared with the 1-percent increase for all manufacturing industries. A rising population coupled with the growth of individual incomes should result in a continuing demand for metal consumer products such as automobiles, heating and cooking equipment, and home freezers. Anticipated continued expansion in expenditures for new plants and equipment should result in a growing volume of metal products used by industry such as machinery, engines, pumps, and instruments.

In the maintenance shops of nonmetalworking industries, long-run growth in machining employment also is expected. As a whole, these industries have increased with growth in population and higher national income. Moreover, the gradual mechanization of industry tends to expand the need for maintenance machining workers to keep mechanical equipment in good condition. Many of these nonmetalworking industries are much less affected by changes in general business conditions than are the metalworking industries, so that machining workers in the nonmetalworking industries tend to have fairly steady employment over the years.

Employment opportunities for machining workers will also be affected by defense activities. Although it is difficult to make long-range projections of defense expenditures, it appears likely that the Armed Forces during the 1960's will increase their purchases of metal products. Many of these products will be made of new materials that will require special machining skills.

Employment in the individual machining occupations is expected to increase at varying rates. Technological changes now developing are expected to result in a slower rate of employment growth for machine tool operators, setup men, and layout men than is anticipated for tool and die makers, instrument makers, and machinists. One of these developments is the use of automated machining lines in which machine tools are linked together for automatic production operations.

The numerical control of machine tools is another technological advance which, if widely introduced, could be a major factor in significantly affecting both the skill requirements and the employment of machine tool operators and setup men. The use of such controlled machine tools broadly involves the following sequence of operations: Engineers or draftsmen translate part dimensions and tolerances, cutter shapes and sizes, cutting paths and sequences, and other data into numbers, or codes representing numbers. The data are then punched onto tapes or cards which are inserted into electronic devices that automatically operate the machines. The machine tool operator installs the tool, inserts and removes the workpiece, and changes the tapes or cards.

Numerically controlled machine tools would thus simplify the job of the machine tool operator as well as reduce machining time. Although it is still too early to measure the effect of this technological development, if numerically controlled machine tools should prove economical and generally be adopted, the growth of employment in machining occupations—particularly machine tool operators—would be slowed. (A more detailed discussion of the employment outlook in individual machining occupations is presented in the individual sections later in this chapter.)

In addition to the expected rise in machining employment, replacement needs will create thousands of openings. Retirements and deaths of experienced men alone will provide about 20,000 openings annually during the 1960's. This will be a particularly important factor in the skilled machining occupations, which have a relatively high proportion of older workers. In the less skilled occupations, shifting into other lines of work is fairly common and many thousands of other openings will arise in this way.

Earnings and Working Conditions

The earnings of skilled machining workers generally compare favorably with those of other skilled industrial workers. Tool and die makers and instrument makers are the highest paid workers in the machining group, and among the highest paid skilled workers in manufacturing. Detailed earnings information is presented in most of the discussions of the individual occupations.

Most of the shops in which machining workers are employed are fairly clean, well lighted, and free from dust. Safety instructions are an important part of job training. Because they work with high speed machine tools and sharp cutting instruments, workers in these occupations need good safety habits. Persons working around machine tools are prohibited from wearing loose fitting clothing and frequently wear protective goggles.

Machining work is not physically strenuous. The machine tools do the actual cutting while the machining worker sets the machine, watches the controls, and checks the accuracy of the work. The workers, however, usually stand at their jobs most of the day and must be able to move about freely.

Machining workers are employed by companies which generally provide paid holidays and paid vacations. Other benefits available to some of the workers in these occupations include life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and pensions.

The great majority of machining workers are members of unions. Among the labor organizations in this field are the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Where To Go for More Information

The National Tool & Die Manufacturers Association, 907 Public Square Building, Cleveland 13, Ohio, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U.S. Bureau of Apprenticeship and Training. Many local offices of the State employment service, affiliated with the U.S. Employment Service, offer free aptitude testing to persons interested in determining their capacity to acquire the skills necessary for the all-round machinist and tool and die making trades. The State employment service also refers applicants for apprentice programs to employers. Apprentice information also may be secured from unions in this field. In many communities, applicants for apprenticeship are also received by labor-management apprenticeship committees. If no union is listed in the telephone book, an applicant may write to the following national headquarters and asks them to refer the letter to their nearest branch.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington 6, D.C.

International Union, United Automobile, Aircraft & Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 14, Mich.

International Union of Electrical, Radio and Machine Workers,
1126 16th St. NW., Washington 6, D.C.

All-Round Machinists

(D.O.T. 4–75.010 and .120)

Nature of Work

The all-round machinist is a skilled metal worker who shapes metal parts by using machine tools and hand tools. Variety is the main feature of his work. His training and experience enable him to plan and carry through all the operations needed in turning out a machined product and to switch readily from one kind of product to another. An all-round machinist is able to select the proper tools and material required for each job and can plan the cutting and finishing operations in their proper order so he can complete the finished work according to blueprint or written specifications. He makes standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining. He often uses precision-measuring instruments such as micrometers and gages to measure the accuracy of his work to thousandths of an inch.

These skilled workers must be able to set up and operate most types of machine tools. After completing machining operations, they may finish the work by hand, using files and scrapers. They

All-round machinist operating a milling machine.

may assemble the finished parts with wrenches and screwdrivers. The all-round machinist also must know the composition of metals so he can "heat treat" cutting tools and parts by heating and quenching them to improve machinability. His wide knowledge of shop practice and the working properties of such metals as steel, cast iron, aluminum, and brass, and his understanding of what the various machine tools do, make it possible for him to turn a block of metal into an intricate, precise part.

Machinists employed in maintenance departments to make or repair metal parts of machines and equipment also must have a broad knowledge of mechanical principles. They sometimes are required to adjust and test the parts they have made or repaired for proper operation in a machine.

Where Employed

Almost every factory using a substantial amount of machinery employs maintenance machinists to keep its mechanical equipment operating. The majority of the 265,000 machinists in late 1958 were employed in the maintenance shops of a wide variety of industries such as the railroad, textile, automobile, and printing industries. Many are employed in Navy yards and other installations of the Federal Government. Some machinists are employed in production jobs in metalworking factories where large quantities of identical parts are produced, as well as in machine shops where a limited number of varied products are made.

One of the advantages of the machinist occupation is that workers in this occupation are employed in almost every locality and industry because their skills are required to maintain all types of machinery. The largest number of machinists jobs are found in the States where the metalworking industries are concentrated. About half of the machinists work in the metalworking States—New York, California, Pennsylvania, Ohio, Illinois, Michigan, New Jersey, and Massachusetts.

Training, Other Qualifications, and Advancement

According to most authorities, a 4-year apprenticeship is the best way to learn the machinist trade. Many machinists, however, have qualified without an apprenticeship by picking up the trade over years of varied experience in machining jobs.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do exacting work. A high school or vocational school education is desirable preparation for machinist training and is required by many employers. Courses in mathematics and science are helpful to the apprentice applicant.

A typical machinist apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. Shop training includes the learning of proper speeds and the operation of the various types of machine tools. The apprentice also is taught chipping, filing, hand tapping, dowel fitting, riveting, and other hand operations. In the classroom, the apprentice studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

The increasing use of electronic controls and hydraulic operation of machine tools is affecting the skill requirements for all-round machinists. If possible, young persons entering this occupation should acquire a knowledge of electronics and hydraulics in addition to their machinist training so that they will be prepared for future technological developments.

A machinist who has just finished his apprentice training often is assigned the job of operating a single type of machine tool. With additional experience, he then may be assigned to jobs requiring him to operate several types of machine tools as well as to perform hand operations. Some journeymen machinists, however, remain skilled machine tool specialists and do highly skilled work with one type of machine tool.

Numerous promotional opportunities are available to all-round machinists. Many advance to foreman of a section or to other supervisory jobs. With additional training, some develop into tool and die makers and, in some instances, instrument makers. Others are successful in opening and operating machine shops of their own.

Employment Outlook

There will be many opportunities for new workers to obtain jobs as machinists in the 1960's. Some of these opportunities will develop because of the expected increase in employment in this occupation. This is a relatively large occupation and thousands of new workers also will be needed each year to replace those workers who retire, die, or transfer to other fields of work. Retirements and deaths alone will result in about 6,000 job openings annually during the 1960's.

The employment of machinists is expected to increase both in the nonmetalworking and metal working industries. American industry is continuing to use a greater volume of more complex machinery and equipment. Plants with highly mechanized operations will require more machinists. As manufacturing operations become more interrelated by the combining of automatic machines, breakdowns become more costly and time consuming. Therefore, maintenance and repair activities become far more important and the employment of skilled machinists becomes more necessary to insure continuous production.

Earnings and Working Conditions

The earnings of all-round machinists compare favorably with those of other skilled factory workers.

Bureau of Labor Statistics wage studies in 15 selected areas in 1958–59 give an indication of the general level of earnings of maintenance machinists. Average straight-time hourly earnings of maintenance machinists ranged from $2.35 in Dallas to $3.06 in Detroit, as shown below:

Baltimore	$2. 90
Boston	2. 60
Buffalo	2. 82
Dallas	2. 35
Denver	2. 62
Detroit	3. 06
Los Angeles–Long Beach	2. 94
Memphis	2. 49
Minneapolis–St. Paul	2. 82
Newark–Jersey City	2. 82
New Orleans	2. 66
Philadelphia	2. 70
St. Louis	2. 93
San Francisco–Oakland	3. 02
Seattle	2. 78

Machinists must follow strict safety regulations when working around high speed machine tools. The greater use of safety goggles and other protective devices in recent years has reduced the accident rate for these workers.

Most of the companies which employ machinists provide paid holidays and paid vacations. Some machinists also may receive benefits such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and a retirement pension.

Many machinists belong to unions. Among the labor organizations which include machinists in their membership are the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the United Steelworkers of America.

(See introductory section of this chapter for Where To Go for More Information.)

Tool and Die Makers

(D.O.T. 4–76.010, .040, and .210)

Nature of Work

Tool and die makers are highly skilled workers who make the tools and dies used in shaping and forming metal parts. Tool makers specialize in producing the jigs and fixtures—the devices required to hold metal while it is being shaved, stamped, or drilled. They also make gages and other measuring devices needed in the manufacture of precision metal parts. Die makers construct the dies—the metal forms for shaping metal by stamping and forging operations. They also make the metal molds used in die-casting and in molding plastics. Another important part of the job of tool and die makers is the repair of dies, gages, jigs, and fixtures. Some tool and die makers also do part of the actual tool and die designing.

Tool and die makers use many types of machine tools and a wide variety of precision-measuring instruments. They must have an all-round knowledge of the machining properties of common metals and alloys. Above all, tool and die makers must have a broad knowledge of all machining operations, shop practices, mathematics, and blueprint reading. In addition, they must be able to work to closer tolerances and do more precise handwork than most other machining workers. These requirements, and the specialization in tools and dies, distinguish these craftsmen from the other machining workers.

Where Employed

The 135,000 tool and die makers working in 1958 were primarily employed in metalworking industries. The automobile industry, which is a large employer of these craftsmen, employed from 15,000 to 20,000 tool and die makers. The thousands of tool and die jobbing shops, which make tools, dies, jigs, fixtures, and other machine tool accessories for other companies on individual order, together employ about as many tool and die makers as does the automobile industry. Many tool and die makers work in machinery plants, such as those making farm machinery and tractors, machine tools, and industrial machinery and equipment. Companies manufacturing electrical machinery, aircraft and missiles, and fabricated metal products are other important employers of tool and die makers. These skilled craftsmen also are employed in the nonmetalworking industries. For example, the plastics products industry employed about 3,000 tool and die makers in late 1958 to make metal molds.

Nearly 50 percent of the tool and die makers are employed in the 5 States of California, Ohio, Michigan, New York, and Illinois. Other States ranking high in the employment of these skilled craftsmen are Pennsylvania, New Jersey, Indiana, and Massachusetts. Detroit, Cleveland, and Chicago are important job centers for tool and die makers.

Training, Other Qualifications, and Advancement

Tool and die making requires rounded and varied training and experience which is generally obtained through formal apprenticeship or its equivalent in other types of on-the-job training. Since this is one of the most exacting metal machining jobs, persons planning to enter this trade should have a knowledge of mathematics and

Apprentice receiving some pointers on the construction of dies from experienced tool and die maker.

considerable mechanical ability, finger dexterity, and a liking for painstaking work. In selecting apprentices, most employers prefer young men with high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their ability to work with mathematics.

A tool and die apprenticeship ordinarily lasts 4 or 5 years. Most of the time is devoted to practical shop training, but some classroom work also is part of the training program. During the shop training period, the apprentice learns to operate the major machine tools, such as lathes, milling machines, grinders, and shapers. He also is taught the use of handtools, such as scrapers and files, for the fitting and assembling of tools, dies, gages, jigs, fixtures, and machines. Tool and die makers also must master heat treating and other metalworking processes. Related classroom training in shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading also is given to apprentices. After apprenticeship, a number of years of experience as journeyman often is considered necessary to qualify for the more difficult tool and die work. Some companies separate their toolmaking and diemaking apprenticeship programs.

A study by the Bureau of Labor Statistics indicated that many metal machining workers have become tool and die makers without going through a formal apprenticeship program. These men, after years of experience as machine tool operators and with supplemental vocational or correspondence school training, have developed into all-round workers who are able to perform almost any metal machining operation, including tool and die making, with a high degree of skill.

The increasing complexity of modern machinery and metalworking equipment is raising the technical and mental skill requirements for tool and die making. A knowledge of mathematics, the basic sciences, electronics, and hydraulics will give young persons entering this occupation greater opportunities to further their careers.

An early investment in a thorough training for this occupation may lead to better paying jobs in the future. Men with tool and die training often are selected for supervisory and administrative positions in industry. Many tool and die makers become tool designers. Others may open their own tool and die jobbing shops.

Employment Outlook

An increasing number of tool and die makers will be needed in the 1960's as a result of the anticipated expansion of metalworking activity. In addition, many openings will be created by those workers who retire, die, or transfer to other fields of work. Retirements and deaths alone will create about 3,000 job openings annually in the 1960's.

The anticipated long-range expansion in the aircraft and missile, machinery, and other metalworking industries will result in a continued increase in the employment of tool and die makers. The skills of these key workers are needed to make the dies and tools used to produce the thousands of identical metal parts made in these industries.

Unlike most other machining workers whose employment may be adversely affected by future technological changes, more tool and die makers will be needed to help put these technological developments into effect. For example, more tool and die makers are needed to make and repair the dies and holding devices used in the automated machining lines in the mass-production industries.

Tool and die makers, as a group, have a longer working life than many other workers in the labor force. Their jobs require extensive skill and knowledge which can be acqured only after years of experience. These skilled craftsmen also have more job mobility than most other skilled workers. They can transfer readily from one metal working industry to another. Furthermore, they have greater occupational mobility than other workers. For example, skilled tool and die makers can transfer to jobs as instrument makers or machinists.

Earnings and Working Conditions

Tool and die makers are among the highest paid metal machining workers. A 1958–59 wage study of the machinery manufacturing industries by the Bureau of Labor Statistics shows the following average straight-time hourly earnings of production tool and die makers in job shops:

Boston	$2. 63
Buffalo	2. 66
Chicago	3. 30
Cleveland	2. 86
Detroit	3. 50
Hartford and New Britain–Bristol	2. 53
Los Angeles–Long Beach	3. 00
Milwaukee	3. 00
Minneapolis–St. Paul	2. 86
Newark–Jersey City	2. 77
New York City	2. 73
Philadelphia	2. 99
Pittsburgh	2. 91
Worcester	2. 40

Tool and die makers in maintenance jobs, based on Bureau of Labor Statistics occupational wage surveys in 14 selected areas in 1958–59, were paid average straight-time hourly earnings ranging from $2.72 in Dallas to $3.38 in the San Francisco–Oakland area.

Because tool and die makers do precision work, the areas in the plants or shops in which they work are generally clean and well-lighted. Tool and die makers stand part of the time when they are operating machine tools. At other times they do handwork at benches. Sometimes they go into the plant to test at the machines, the tools and dies they have made.

Good safety habits are necessary for tool and die makers because they work with high speed machine tools and sharp cutting instruments. The use of safety devices has reduced the injury rate for machining workers in recent years.

Most tool and die makers are members of such unions as the International Association of Machinists; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the United Steelworkers of America; and the Mechanics Educational Society of America. Labor-management contracts covering these workers often provide benefits such as life and health insurance, and pension plans.

(See introductory section of this chapter for Where To Go for More Information.)

Instrument Makers

(D.O.T. 4–75.010 and .130)

Nature of Work

The increasing emphasis upon research, development, and testing work in industry and government and the growing dependence upon instruments in industrial production are making the job of the instrument maker increasingly important. Instrument makers, who often have other job titles such as experimental or laboratory machinist or modelmaker, work closely with engineers and scientists in translating designs and ideas into experimental models, special laboratory equipment, and other nonstandard instruments. Such work also includes changing existing instruments to serve special purposes. Some of the devices constructed by these craftsmen for experimental purposes are used to measure heat (thermostats) and distance (geodimeters), record earthquakes (seismographs) and help control industrial processes (servo-mechanisms). The instrument parts and models made by these workers range in complexity from simple gears to the intricate navigation systems used in guided missiles.

In performing their work, instrument makers frequently use skills which are similar in many respects to those of all-round machinists, tool and die makers, and layout men. Like these other machining workers, instrument makers fabricate metal parts by operating machine tools such as lathes and milling machines, and by using handtools such as files and chisels. They also determine the sequence of machining operations and follow blueprint instructions. Because the parts on which they work must be machined precisely, finished parts must be accurately measured with micrometers and standard optical measuring instruments. Finally, instrument makers and the other machining workers make devices needed to hold metal parts in place and to guide the tools which shape them.

However, there are certain significant differ-

Instrument maker using ultrasonic machine tool.

ences between instrument makers and these other machining workers. Generally, instrument makers work more from rough sketches, verbal instructions, or only ideas given to them by a scientist or engineer. To solve the practical fabrication or design problems that arise from such directions, they frequently must use considerable imagination and ingenuity. Furthermore, instrument makers often do more exacting work than other skilled machining workers because the parts on which they work sometimes may not vary more than one ten-thousandths of an inch (which is 30 times smaller than a human hair) or even a few millionths of an inch. In order to meet such standards, instrument makers commonly use special equipment or precision devices, such as the electronic height gage and the cavitron (a machine tool which shapes hard materials by means of vibrations), which are used only infrequently by other machining workers. Another important difference is that instrument makers work with a greater variety of materials; they have to know the working properties of plastics, wood, glass, and rubber, as well as the rarer metals such as silver, platinum, and tungsten.

Instrument makers must be able to construct instruments from start to finish—making the metal parts, assembling them into complete instruments, and testing the finished instrument to see that it performs the operation for which it was intended. However, in large companies or where time is important, an instrument maker often will not assemble an entire instrument. In such instances, he will cooperate with other instrument makers, each making a complete part or component of some larger and more complicated instrument.

Because they work with minimum supervision and possess highly developed manual skills and reasoning abilities, instrument makers have considerable prestige and are often referred to as "master mechanics."

Where Employed

Most instrument makers are employed by firms which manufacture industrial instruments; laboratory equipment; nautical, aeronautical, and military instruments; optical products; and recorder-controllers. The Federal Government employed about 1,200 instrument makers in 1958, most of whom worked in the following agencies: Army, Navy, Air Force, National Institutes of Health, Coast and Geodetic Survey, National Bureau of Standards, and the National Aeronautics and Space Administration. University and commercial research laboratories also employ instrument makers to make the special devices required in scientific research.

The main centers of instrument making are located in and around a few large cities, particularly Rochester, N.Y., New York City, Chicago, Minneapolis-St. Paul, Los Angeles, Boston, Philadelphia, and Washington, D.C.

Training, Other Qualifications, and Advancement

Most instrument makers advance from the ranks of machinists or skilled machine-tool operators. These craftsmen, working at first under close supervision and doing the simpler jobs in the instrument shop, usually need at least 1 or 2 additional years of experience to qualify as instrument makers.

Other instrument makers learn their trade through instrument-maker apprenticeships which generally last 4 or 5 years. The apprentice's shop training emphasizes the use of machine tools, handtools, and measuring instruments, and the working properties of various materials. Classroom instruction covers related technical subjects such as mathematics, physics, and blueprint reading. The apprentice must learn enough shop mathematics to enable him to plan his work and use handbook formulas. A basic knowledge of mechanical principles is needed in solving gear and linkage problems.

Employers generally prefer applicants who have a high school education, including courses in algebra, geometry, trigonometry, science, and machine shop work. Further technical schooling in electricity and electronics is often very desirable, and may make possible future promotions to technician positions.

A young man interested in becoming an instrument maker should have a strong interest in mechanical subjects and a better-than-average ability to work with his hands. More importantly, he must have great initiative, resourcefulness, and ingenuity, because instrument makers often work alone and almost always under minimum supervision. Since the instrument maker also faces problems which may not have been solved previously, he must be able to develop original solutions. The instrument maker frequently must visualize the relationship between individual parts and the complete instrument. He must also understand how the instrument is used and the principles of its operation. Because of the nature of his work the instrument maker has to be very conscientious and take considerable pride in creative activity. For all these reasons, this is an occupation which requires flexibility in working with new ideas, new tools, and new materials, and the willingness to work on nonroutine assignments.

As the instrument maker's skill improves and as he broadens his knowledge, he may advance to increasingly responsible positions. About 10 years' experience is required to rise to the top skill level in instrument making. With additional training beyond the high school level in subjects such as physics and machine design, some instrument makers may advance to technician jobs. In these jobs, technicians plan and estimate time and material requirements for the manufacture of instruments, or provide specialized support to professional personnel. Others may become supervisors of less skilled instrument makers and help in their training.

Employment Outlook

The employment of instrument makers is expected to continue to increase rapidly during the 1960's. However, the number of new openings in any one year will be limited by the relatively small size of the occupation. Probably not more than 30,000 workers were employed as instrument makers in 1958.

The devices made by instrument makers have played a key role in the remarkable expansion of science and technology which is revolutionizing our industry and defense. Instruments are of basic importance in atomic energy, guided missiles, and "automation" (the use of instruments to direct and control manufacturing processes). In addition, new electronic communication equipment and computers also depend upon the development of instruments.

Research and development expenditures, which reached an estimated $10 billion in 1958, are expected to increase in the next decade, and will have a favorable effect upon instrument maker employment. New precision instruments which will be even more versatile and sensitive than those in current use are expected to emerge from the future research and development programs of universities, government agencies, private laboratories, and manufacturing firms.

Many critical technical problems can be solved only by the development of new instruments. For example, scientists who work with atomic reactors need better control systems for indirect handling of radioactive materials and improved "thermometers" which can measure temperatures in the millions of degrees.

Spending for research and development and for replacement of obsolete equipment will contribute importantly to the very large increase which is anticipated in instrument sales, but employment of instrument makers probably will rise more slowly than sales. In many cases, instruments can be standardized and produced in large quantities, without hiring additional instrument makers. In these instances, the work can be broken down into several simple steps and performed by semiskilled assemblers.

However, the possibilities for specialization in skills and standardization of the processes of instrument manufacturing are limited. There are indications that unique, custom-made, and special purpose instruments, all typical products of the instrument maker, will be of increasing importance, especially in fast-changing fields such as the electronic, petroleum, and chemical industries. Opportunities for specialization also are limited in laboratories and model shops which do not produce large quantities of any one instrument. Another limit to specialization in instrument making is that laboratory and model shop instrument workers must be all-round craftsmen even to perform apparently specialized tasks such as precision grinding and drilling.

In addition to new job opportunities for instrument makers that will occur as a result of expanded industrial, scientific, and defense requirements, there will be several hundred new openings annually for these craftsmen as a result of retirements and deaths, promotions to technician positions, and transfers to other fields of work.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. Wage data obtained from a small number of instrument manufacturers and research laboratories and from selected union contracts indicate that wages of these craftsmen in 1958 generally ranged from $2.50 to $3.25 an hour. A few skilled instrument makers employed by the Federal Government in Washington, D.C., were receiving hourly pay of $3.50; others received annual salaries ranging from $4,490 to $7,335.

Instrument shops are usually not as noisy as other places where machining workers are employed. Generally, the machines do not run continuously and many of the machine tools are quite small.

Serious work accidents are not common among instrument makers, but machine tools and flying particles sometimes cause finger, hand, and eye injuries. Safety rules generally require the wearing of special glasses, aprons, tightly fitted clothes, and shirts with elbow-length sleeves; the wearing of neckties is prohibited.

Many instrument makers belong to unions, two of which are the International Union of Electrical, Radio and Machine Workers and the International Association of Machinists.

(See introductory section of this chapter for Where To Go for More Information.)

Machine Tool Operators

(D.O.T. 4–78.000 through .589 and 6–78.000 through .589)

Nature of Work

Machine tool operators shape metal to precise dimensions by the use of machine tools. However, unlike the all-round machinists who are expected to be able to operate all machine tools, machine tool operators are generally limited to the operation of one or two machine tools. There is a wide range of skills among the workers who operate machine tools. Many operators are essentially machine tenders who perform simple operations which can be learned quickly. In contrast, other machine tool operators are much more skilled and can perform complex machining operations. The work of these skilled machine tool operators is similar to that of the all-round machinists, except that it often is limited to a single type of machine and little or no hand fitting or assembly work is performed.

The skilled machine tool operator works from blueprints or layouts in order to plan the correct sequence of operations. He sets up the machine for each machining operation by adjusting feed and speed controls and he selects the proper cutting tools. Adjustments may be necessary during the machining operations and frequent changes in setup often are required. Therefore, the skilled operator must be adept in using all the

Machine tool operator grinding the surface of a metal part.

special attachments of his machine. Upon completion, he checks the finished work with micrometers, gages, and other precision-measuring instruments to see whether all specifications have been met. The skilled machine tool operator also may be required to select proper coolants such as cutting and lubricating oils used to keep the metal and tools from becoming too hot during the machining operation.

The majority of machine tool operators are much less skilled than the specialists described above. Semiskilled operators do repetitive rather than varied work. A typical assignment of the semiskilled operator is to place the rough metal stock into an automatic machine tool on which the speeds, feeds, and operation sequence have been set. He watches the repetitive operations of the machine and calls for his supervisor when trouble arises. Specially prepared gages which simplify measurement often are used by a semiskilled operator. The operator with limited training may make minor adjustments to keep the machine tool in operation, but he depends on more skilled men for major adjustments.

Lathes, drill presses, boring machines, grinding machines, milling machines, planers, and shapers are among the important machine tools used by machine operators. Both skilled and semiskilled operators are given a job title based upon the kind of machine they operate, such as engine lathe operator, milling-machine operator, and drill press operator.

Where Employed

Machine tool operators are primarily employed in metalworking factories where metal parts for automobiles, aircraft engines, machinery, and other metal products are manufactured on a mass-production basis. The size of the plant, the organization of the work sequence, and the extent of the simplification of machining operations determine whether employers will use semiskilled or skilled operators. Because of their limited training, few semiskilled operators can be used in either the maintenance departments of a plant or in a machine shop which does small job lot production work on a contract basis. Skilled machine tool operators, on the other hand, because their greater skills give them wider job opportunities, are employed in production, job, or maintenance shops, and in tool rooms.

Machine tool operator jobs are found in greatest number where the metalworking industries are located. The six States leading in the employment of operators are Ohio, Illinois, Michigan, New York, California, and Pennsylvania.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. After a new worker is hired, he usually starts his training by observing a skilled operator at work. When the learner is put in charge of a machine, he often continues to be supervised by a more experienced worker. In most cases, the new worker learns on the job to read measuring instruments and to make the elementary computations needed for shop work.

As the operator acquires experience and learns the various aspects of machine tool operation, and as he becomes proficient in reading blueprints and planning the sequence of machining work, he may move into the skilled operator category. Many all-round machinists and tool and die makers began their careers as operators.

Some of the larger companies conduct formal training programs for their new employees. A combination of classroom and on-the-job instruction is offered to acquaint the new worker with the details of machine tool operation and machining practice. The length of time required to become a machine tool operator depends, to a great extent, on individual ability. Semiskilled machine tool operators generally learn their jobs within a few months. A period of 1½ to 2 years of on-the-job training and experience generally is required to become a skilled machine tool operator. Some of the more highly skilled machine tool operators' jobs are filled by men who have completed machinists apprenticeships.

Although there are no special educational requirements for semiskilled operator jobs, prior knowledge of mathematics and blueprint reading will improve the job opportunities for young persons seeking such jobs. In hiring unskilled operators, employers also often look for persons with mechanical aptitude who have had some experience working with machinery.

Employment Outlook

The anticipated increase in employment in the metalworking industries in the 1960's is expected to result in a growing demand for machine tool operators. In addition to the demand created for these workers by the growth of the metalworking industries, the need to replace those workers who retire, die, or transfer to other fields of work will also create a considerable number of job opportunities each year for new workers to enter this occupation. Retirements and deaths alone will create about 10,000 job openings each year during the 1960's.

Technological developments, however, may affect both the number and skill requirements of machine tool operators. The continued development and use of faster and more versatile automatic machine tools will result in greater output per machine tool operator.

If the use of numerically controlled machine tools should become widespread, this could slow up somewhat the anticipated increase in the employment of machine tool operators. In this method of machining, part dimensions, tolerances, cutter shapes and sizes, cutting paths, and sequences are translated into numbers or codes representing numbers. The numbers are punched on cards or tapes which can be inserted into electronic devices which then run the machine tool automatically. This method reduces and simplifies the work of the machine tool operator.

However, as with the technological changes of the past, the electronic control of machine tools by punched tapes or cards will probably be introduced very gradually and have little immediate effect upon the employment and skill requirements of machine tool operators. Those workers who have a thorough background in machining operations, mathematics, blueprint reading, and a good working knowledge of the properties of metals should be able to adjust with little difficulty to the future technological changes anticipated in the machining field.

Earnings and Working Conditions

Machine tool operators are paid on an hourly rate or incentive basis, or on the basis of a combination of both methods of wage payments. Operators employed in production shops are usually classified as class A, class B, and class C operators according to their skill level. Class A operators are the most highly skilled and usually are paid the highest rates. According to a wage study of the machinery manufacturing industry conducted by the Bureau of Labor Statistics in selected areas in 1958–59, the average straight-time hourly earnings for class A drill press, engine lathe, and milling machine operators were as follows:

City	Drill-press operators, single or multiple spindle, class A	Engine-lathe operators, class A	Milling machine operators, class A
Baltimore	$2.26	$2.45	$2.71
Boston	2.66	2.34	2.60
Buffalo	2.48	2.49	2.48
Chicago	2.56	2.68	2.74
Cleveland	2.81	2.55	2.66
Dallas		2.32	2.24
Denver		2.64	2.99
Detroit	2.69	3.14	3.15
Hartford and New Britain–Bristol	2.19	2.48	2.40
Houston	2.37	2.69	2.52
Los Angeles–Long Beach	2.31	2.65	2.58
Milwaukee	2.70	2.67	2.71
Minneapolis–St. Paul	2.37	2.40	2.42
Newark–Jersey City	2.26	2.47	2.58
New York City		2.55	2.51
Philadelphia	2.27	2.62	2.56
Pittsburgh		2.97	2.76
Portland (Oreg.)		2.63	2.62
St. Louis	2.39	3.02	3.11
San Francisco–Oakland		2.92	2.91
Worcester	2.25	2.30	2.29

Machine tool operators must follow safety precautions. They are required to wear protective goggles and to avoid the wearing of loose-fitting garments when working around high speed machine tools. Increasing emphasis upon safety regulations has reduced the accident rate for these workers in recent years.

Many machine tool operators are members of unions. Among the labor organizations active in the factories where operators are employed are the International Association of Machinists; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and the United Steelworkers of America. Most labor-management contracts provide for health insurance, life insurance, and pension benefits.

(See introductory section of this chapter for Where To Go for More Information.)

Setup Men (Machine Tools)

(D.O.T. 4–75.160)

Nature of Work

The setup man, often called a machine tool job setter, is a skilled specialist employed in plants and machine shops which do machining in large volume. His job is to install cutting tools and adjust the controls of machine tools so that they can be run by semiskilled operators. He must be able to explain the operations to be performed and show how machining accuracy can be checked.

The usual practice is to assign a setup man to a number of machine tools, which are often of one type, such as the turret lathe. Working from drawings, blueprints, written specifications, or job layouts, he determines feeds, speeds, tooling, and operation sequence, and adjusts guides, stops, and other controls accordingly. After setting up a machine, he may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned over to a semiskilled operator. During the machining operation, the setup man makes adjustments for the machine tool operator so that accurate production is maintained.

Where Employed

Most setup men are found in factories in metalworking industries such as the machinery, the automobile, and the aircraft industries which employ large numbers of semiskilled machine tool operators. These highly skilled workers are usually not employed in maintenance shops or in small jobbing shops. Setup men are located mostly in the States of Ohio, Illinois, Michigan, New York, and California.

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Training and Other Qualifications

To become a setup man, it is usually necessary first to qualify as an all-round machinist or as a skilled machine tool specialist, because a setup man must be thoroughly trained in the operation of one or more machine tools. He must also learn to read blueprints and make computations in selecting speeds and feeds for machine tools. He must learn to explain to a semiskilled machine tool operator the operations to be performed and how to check machining accuracy. Above all, a setup man must learn the sequence of operations so that the metal parts being produced by the semiskilled operators under his supervision will be made exactly to specifications. Jobs for setup men are usually filled from within the shop by promotion or reassignment rather than through hiring from the outside.

Employment Outlook

There should be a moderate increase in the employment of setup men in the 1960's. This is a small occupation which will provide a relatively small number of job opportunities for new workers in the next decade.

The widespread use of numerical control machine tools would limit employment growth in this occupation. However, as with other technological changes, punched tape and card controls will probably be introduced gradually and have little immediate effect upon the employment of setup men.

(See introductory section of this chapter for Where To Go for More Information.)

Layout Men

(D.O.T. 4–75.140)

Nature of Work

The layout man is a highly skilled specialist who makes guidemarks on metal before it is machined to indicate to machine tool operators the kind of machining needed. Working from blueprints, drawings, or written specifications, the layout man marks instructions, guidelines, and reference points on rough castings, forgings, or metal stock. He uses a wide assortment of instruments, including the scriber, with which he marks lines on the surface of the metal; the center punch to indicate the centers on the ends of metal pieces to be machined or drilled; the keyseat or box rule for drawing lines and laying off distances on curved surfaces; dividers, for transferring and comparing distances; L- or T- squares for determining right angles; and calipers and micrometers for accurate measurement. Not only must the layout man work with extreme accuracy, but he also must be familiar with the operation and uses of each of the standard machine tools.

Where Employed

Layout men work primarily in the mass-production metalworking industries employing large numbers of machine tool operators. Most of the layout men work in plants producing electrical machinery and transportation equipment. Many are employed in Ohio, Illinois, Michigan, New York, and California.

Training and Other Qualifications

From 6 to 10 years is required to develop the skill for this exacting job. The training includes the machinist apprenticeship or the equivalent preparation needed to learn all machine tool operations, the machining qualities of metals, and the proper sequence of machining operations.

A layout man must be well trained in mathematics and blueprint reading. He must be adept in using a wide variety of precision-measuring tools.

Mechanical ability and the inclination to do painstaking work are important qualifications for layout men. Above all, layout men must learn to visualize the sequence of machining operations so they can correctly lay out in detail the plan of work for machine tool operators. These skilled jobs usually are filled from within an establishment by promotion or reassignment.

Employment Outlook

Employment is expected to increase slowly in this small occupation in the 1960's. The anticipated large increase in metalworking activity —particularly in plants employing large numbers of machine tool operators—will result in an increased employment of layout men. Replacement needs also will provide a small number of job opportunities for skilled machinists to be promoted to jobs as layout men.

(See introductory section of this chapter for Where To Go for More Information.)

COURTESY OF U.S. NAVAL GUN FACTORY

Layout man marking lines and reference points on a casting with a surface gage to guide the machine tool operator.

FOUNDRY OCCUPATIONS

Foundry work or metal casting is one of the principal metalworking fields. Many of the 370,000 workers employed in the Nation's 5,000 foundries in late 1958 were employed in skilled occupations. Earnings in many foundry occupations are above the average for factory work as a whole.

Metal casting consists of preparing a mold with a cavity in the shape of the article to be made; metal is then melted and poured into the cavity where it cools and hardens into the desired form. Casting is one of the major metal shaping methods; others are machining, forging, stamping, and rolling. Casting is an economical way of forming metal into complicated shapes. Castings have considerable strength and rigidity and range in size from a fraction of an inch to many feet. They may weigh anywhere from less than an ounce to many tons. Most castings are used as parts in nearly all types of metal products. Familar cast articles include automobile cylinder blocks, machinery bases, ship propellers, water faucets, aircraft parts, water mains, bathtubs, and cooking utensils.

Nature and Location of Foundry Work

About 280,000 of the foundry industry's workers are employed in iron and steel foundries. Three-fourths of the workers in these foundries work in establishments which produce gray iron castings and the remaining workers are employed in steel and malleable iron foundries. About 90,000 are employed in nonferrous foundries. Most of this group work in foundries which make copper alloy (bronze and brass), aluminum, magnesium, and lead castings. Most foundries specialize in a particular metal since somewhat different methods and equipment are needed for casting the different metals. However, many shops cast several metals. In many foundry occupations, workers can transfer from foundries casting one type of metal to foundries which produce castings of a different metal with little additional training.

In general, castings are produced in small- and medium-size shops. About 80 percent of all foundries employ less than 100 workers. About two-thirds of the foundry workers are employed in independent foundries (shops which sell their castings to other firms) and one-third in foundries that are departments of plants using the castings for their own products.

There are five principal casting methods based primarily on different types of molds. By far the most common method is green sandcasting. In this method, sand composed chiefly of silica and clay is packed (in a container called a flask) around a pattern (a model of the object to be cast). The pattern is withdrawn and molten metal is poured into the mold cavity to form the desired metal shape. The sand mold can be used only once.

A second method, known as permanent molding, employs a metal mold instead of a sand mold. Metal molds, which can be used many times, are used chiefly for casting nonferrous products. They are utilized in centrifugal casting, in which the mold is rotated rapidly while the molten metal is poured into it. This process is especially appropriate for casting articles of cylindrical form like pipes and gun barrels.

Precision investment casting, a third method (often known as the "lost wax" process), utilizes ceramic molds. In this method, a wax or plastic pattern is coated with refractory clay. After the coating hardens, the wax is melted and drained out leaving a mold cavity into which the casting metal is poured. Castings obtained from these molds are very exact and need little machining.

Shell molding, a fourth process, was introduced after the end of World War II and is becoming increasingly important. In this process, resin-bonded sand shells made from master metal patterns replace green sand molds. Advantages of this method are greater precision, good surface finish of the casting, and lower unit cost in quantity production.

Die casting is a machine process in which molten metal is forced under high pressure into steel dies from which the resulting castings are automatically ejected. Because die casting is a separate and distinct process, die-casting jobs are excluded from the estimates of foundry employment made here and from further discussion in this chapter.

The amount of machinery used in the casting process varies widely. At one extreme are shops that use very little machinery. These foundries are usually small, ordinarily use the sand molding method, and produce small amounts of different kinds of castings. They employ all-round molders, the key foundry occupation, and a substantial amount of unskilled manual labor.

At the opposite extreme are the highly mechanized shops that produce large amounts of identical castings. These foundries are usually large. Materials and castings being processed are moved with mechanical conveyers and cranes. These foundries mainly employ machine molding methods. They also may use precision and shell molding techniques. Consequently, they use a relatively small amount of unskilled hand labor. These shops also employ few highly skilled workers since the functions of the all-round molder and coremaker and other skilled jobs are usually divided into narrow specializations and, in part, performed by automatic machines.

There are foundry jobs in every State and almost every large- or medium-size city in the country. Foundries are very frequently located near the plants where their castings are used. As a result, they tend to be concentrated in areas where there is considerable metalworking. The greatest foundry employment is found in the important metalworking States of Ohio, Michigan, Pennsylvania, Illinois, and Indiana.

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Molten aluminum being poured into molds by pourer.

Foundry Occupations

As shown in the table below, about 83.5 percent of the approximately 370,000 workers who had jobs in foundries or foundry departments in late 1958 were employed in plant occupations. More than half of the plant workers had jobs which are not found elsewhere in industry. It is these occupations that are chiefly discussed in this chapter of the Handbook.

Occupational group	Percent of total employment
Total employment	100.0
Nonplant occupations	16.5
Professional and technical	4.2
Managerial	3.5
Clerical and sales	8.8
Plant occupations	83.5
Specialized casting occupations	47.0
Materials movement, mechanical	4.0
Equipment maintenance and repair	7.5
Machining occupations	3.0
Laborers and service occupations	22.0

To explain more clearly the work in a foundry and the duties of individual foundry jobs, a brief description of the work flow of the most common casting process—sand casting—is presented.

The first step in foundry work after the casting has been designed is for the *patternmaker* to make a wood or metal pattern in the shape of the final casting desired. Next, a *hand molder* makes a sand mold by packing and ramming sand, specially prapared by a *sand mixer* (D.O.T. 4-82.310; 6-82.310 and .320), around the pattern. A *molder's helper* (D.O.T. 8-82.10) assists in these operations. When the job calls for large numbers of identical (usually small) castings, a variety of machines are used to perform substantial parts of the molding work at a much faster rate than is possible by hand. An operator of anyone of these machines is called a *machine molder*.

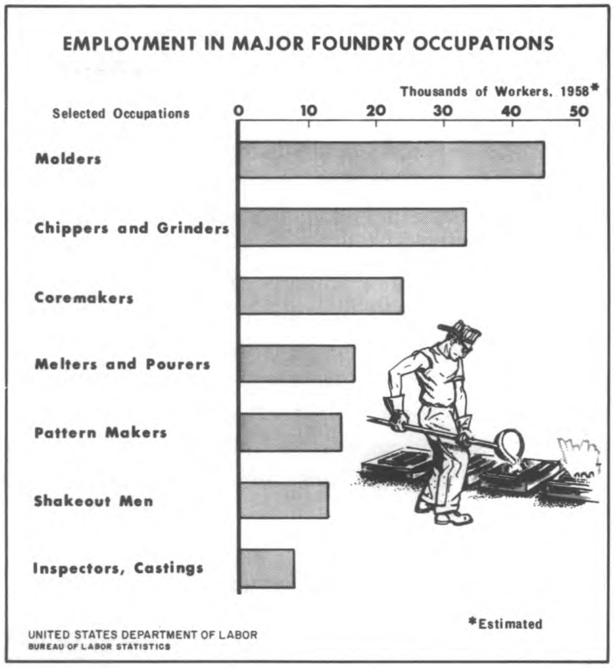
A *coremaker* shapes sand, specially prepared by *sand mixers*, into a core—a body of sand designed to create a hollow space in the casting. The core is baked in a furnace by a *core-oven tender* (D.O.T. 6–82.120). Core parts or sections are put together by a *core assembler* (D.O.T. 6–82.060). The core is then placed in the mold where the hollow space is wanted, and the mold is ready for the metal pouring.

A *melter* (D.O.T. 4–91.351, .411, .441, and .572) operates a furnace that melts the metal. The metal is customarilly poured into the mold by a *pourer* (D.O.T. 6–91.610, .612, and .613), although in some small foundries it is part of the molder's job. When the casting has cooled, it is taken out of the mold by a *shakeout man* (D.O.T. 8–82.10) and sent to the cleaning and finishing department. A *tumbler operator* (D.O.T. 6–82.-730) or a *sandblaster* (D.O.T. 6–82.720) smoothes the rough surfaces of the casting with a machine that tumbles the casting in a revolving drum or blasts the casting with air mixed with abrasive particles. These workers may also operate a machine that both tumbles and blasts the castings. *Chippers* (D.O.T. 6–82.910) and *grinders* (D.O.T. 6–82.330) use pneumatic hammers and powered abrasive wheels to remove excess metal and to finish castings. The casting may be placed in an annealing furnace to improve its physical properties; *annealers* (D.O.T. 6–87.110) run these furnaces. *Casting inspectors* (D.O.T. 6–82.920) then check finished castings for structural soundness and the proper dimensions.

The number of workers in the principal unique foundry occupations are shown in chart 30. Detailed discussions of the duties, training, and other qualifications; earnings; and employment outlook for three principal foundry occupations —molders, coremakers, and patternmakers—will be found at the end of this chapter.

There are many occupations which are not peculiar to foundry work but, nevertheless, make up a substantial part of foundry employment. Among these are about 30,000 workers, such as maintenance mechanics, machinists, carpenters, and millwrights, who maintain and repair foundry plant and equipment. Foundries employed an estimated 7,000 crane and derrick operators and 4,000 truckdrivers in late 1958. In many foundries, some of the castings are machine finished. About 7,500 machine-tool operators do this work. Foundries also employed more than 75,000 workers in relatively unskilled jobs, such as guards, janitors, laborers, and helpers.

CHART 30



About 60,000 foundry workers were employed in professional, office, managerial, or sales jobs. Included in this group were about 7,000 engineers, chemists, metallurgists, and other technical personnel. Some were employed in research activities. Engineers and other technical personnel have been employed in greater numbers in recent years to improve castings to meet new production requirements. Constant effort has been made, for example, to devise methods of reducing the weight of castings without losing strength and other important characteristics. Another facet of current research deals with the problem of obtaining greater accuracy in the molding process. Other engineers and scientists are employed to design and layout machinery and equipment and to supervise plant operation and maintenance.

About 2,000 technicians work in a variety of functions concerned with quality control in casting production. In this group are workers who test molding and coremaking sand, make chemical analysis of metal, and operate machines which test the strength and hardness of castings. Some use X-ray or magnetic apparatus to inspect the internal structure of castings. (A detailed discussion of the duties, training, and employment outlook for engineers, scientists, and other technical personnel appears elsewhere in this Handbook. See index for page numbers.)

The foundry labor force is predominantly male. Women, who make up about 6 percent of the industry's labor force, are primarily employed in office jobs. Negroes make up about one-third of the plant workers in foundries. They are employed in skilled as well as unskilled jobs, with a considerable number working as skilled molders and coremakers.

Training and Other Qualifications

Most foundry plant workers start in unskilled jobs such as laborers or helpers. Specialized jobs in the plant are frequently filled by upgrading. A worker may begin as a laborer and, after receiving informal on-the-job training from a foreman or experienced worker, gradually learns how to perform the more skilled jobs. This is the usual practice in training workers for such direct casting process jobs as melter, chipper, and grinder and frequently is used in the craft maintenance occupations, such as machinist or electrician. The majority of skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this type of training, the young worker is given supervised on-the-job training for a period of from 3 to 5 years, usually supplemented by classroom instruction. A worker who has completed an apprenticeship program is usually preferred by foundry management because of his greater versatility and his increased potential for supervisory jobs.

Employment Outlook

Foundries will provide thousands of job opportunities for new workers during the 1960's. Many of the new job openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Retirements and deaths alone should provide an average of from 7,000 to 10,000 openings annually.

In the post-World War II period, foundry employment has fluctuated sharply in response to business conditions and defense mobilization. Foundries are important producers of war materials and, as a result, boom in mobilization periods. They are also sensitive to downturns in general business. Thus, the business declines which occurred in 1949, 1954, and 1957 resulted in significant drops in foundry employment.

In late 1958, the employment level in foundries was about 20 percent below the employment level in late 1956. During the 1960's, employment is expected to regain the losses resulting from the 1957–58 business downturn and to rise somewhat above the 1956 level. This increase in employment is expected because of the relatively large increase anticipated in foundry output.

Long-range prospects are for a relatively large increase in foundry production. Many of the industries that use large quantities of castings in their products, such as the aircraft, construction, and machinery industries, are expected to expand their output considerably in the 1960's. At the same time, continued advances in casting methods—in machine molding and coremaking—and the increasing use of machinery for material handling will result in greater output per worker. Foundry employment, consequently, is expected to increase at a much lower rate than foundry production.

Some differences are expected in the rate of growth of individual occupations. Little increase is expected in the number of direct process workers, such as hand molders and hand coremakers, while employment of maintenance workers and operators of material moving machines will become more important. The number of laborers and other unskilled workers will decline. Technical personnel will continue to make up an increasingly larger percentage of foundry employment, as scientific techniques in casting replace the old "rule of thumb" methods, and quality and quantity control and research activities increase.

Earnings and Working Conditions

Wages in foundries are somewhat above the average for manufacturing as a whole. In April 1959, according to the Bureau of Labor Statistics production workers in iron and steel foundries earned an average of $98.17 a week or $2.43 an hour (including pay for overtime and night work). In nonferrous foundries, the average was $99.05 a week or $2.41 an hour. This compares with average weekly earnings of $89.87 or average hourly earnings of $2.23 for production workers in all manufacturing industries in the same month.

Working conditions in foundries vary widely. In some foundries, particularly the older unmechanized shops, safety and comfort are below average for factory work, generally. In many of the newer foundries, working conditions have been improved by reducing the heat, fumes, smoke, and noise that are part of foundry operations.

The injury-frequency rate (the average number of disabling work injuries for each million employee hours worked), in foundries tends to be relatively high compared with other manufacturing industries, but it has been going down steadily. For example, in the period from 1947 to 1957, independent gray-iron and malleable foundries reduced their rate from 44.5 to 25.1 and the rate in independent nonferrous foundries declined from 27.0 to 17.9. The average injury-frequency rate for all manufacturing industries was 11.4 in 1957.

The frequency of accidents varies among the different foundry occupations. In general, patternmaking and coremaking have the lowest injury rate; molding has a somewhat higher rate. Jobs in melting and chipping tend to have the highest injury rates.

The large majority of foundry workers are union members. The principal labor organizations to which these workers belong are the International Molders and Foundry Workers Union of North America; the United Steelworkers of America; and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America. Nearly all of the patternmakers are members of the Pattern Makers' League of North America.

Where To Go for More Information

International Molders and Foundry Workers Union of North America,
1225 East McMillan St., Cincinnati 6, Ohio.

National Foundry Association,
53 West Jackson Blvd., Chicago 4, Ill.

Non-Ferrous Founders' Society,
192 N. Clark St., Chicago 1, Ill.

Gray Iron Founders' Society, Inc.,
National City, East Sixth Bldg., Cleveland 14, Ohio.

American Foundrymen's Society,
Golf and Wolf Sts., Des Plaines, Ill.

Malleable Founders' Society,
Union Commerce Bldg., Cleveland, Ohio.

Steel Founders' Society of America,
606 Terminal Bldg., Cleveland 13, Ohio.

Molders

Nature of Work

The molder prepares a mold, made of specially prepared sand, which contains a hollow space in the shape of the item to be made. The mold is made by packing and ramming prepared sand around a pattern—a model of the object to be duplicated— in a molding box called a flask. A flask is usually made in two parts which can be separated to allow removal of the pattern by the molder without damaging the mold cavity. Molten metal is poured into the cavity which, when hardened, forms the casting. The sand is chemically prepared so that it will hold its shape and not crumble when molten metal is poured into the mold. A molder uses rammers, trowels, shovels, mallets, and other hand tools in the handling, compacting, and smoothing of sand in molds made by hand.

The approximately 45,000 molders in this occupation in late 1958 were classified either as hand or machine molders. *Hand molders* use mainly hand methods to make the sand molds. Molds for small castings are usually made on the workbench by *bench molders* (D.O.T. 4–81.010); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 4–81.030). Skill requirements in this occupation

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Hand molder ramming sand around a pattern in the flask.

vary considerably. An all-round hand molder (journeyman) makes many different kinds of molds. A less skilled molder does more repetitive work, specializing in a few simpler types of molds.

Machine molders (D.O.T. 4–81.025 and .050; 6–81.010 and .020), operate one of several types of machines which simplify and speed the making of large quantities of identical sand molds for castings. The machine molders' duties consist mainly of assembling the flask (molding box) and pattern on the machine table, filling the flask with prepared sand, and operating the machine by the properly timed use of its control levers and pedals. Machine molders sometimes are qualified journeyman molders who require little supervision and who set up and adjust their own machines. More commonly, however, the machine molder is a semiskilled worker, whose duties are limited to operating the machine which is set up for him. Machine molders are employed mainly in production foundries which make large quantities of identical castings.

Qualifications and Training

Completion of a 4-year apprenticeship, or the equivalent in experience, is needed to become a journeyman molder and thus qualify for all-round hand molding and for the skilled specialized or supervisory jobs. Men with this training are also preferred for some kinds of machine molding.

The molder apprentice works under the close supervision of journeymen who instruct him in the skills of the craft. About half of the apprenticeship training is devoted directly to molding. The apprentice may begin with a simple job, such as shoveling sand, and gradually take on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. He also learns to operate the various types of molding machines used in the foundry. As his training progresses, he makes complete molds, beginning with simple shapes and progressing to those of increasing complexity. This molding training includes both floorwork and benchwork. In addition, the apprentice works in other foundry departments in order to develop the diversified knowledge of foundry practice needed by fully qualified molders. He is taught sand preparation, melting of metal, and how to clean and finish castings. The apprentice usually receives, in addition, at least 144 hours of classroom instruction each year in such subjects as shop arithmetic, metallurgy, and shop drawing.

It is also possible to develop journeyman skill without apprenticeship training. Molders' helpers and less skilled hand molders sometimes learn the various elements of skilled molding informally, while on the job, and then seek jobs as journeymen. However, this is frequently a lengthier and less reliable way of learning the trade than through apprenticeship.

The less skilled type of hand molding, in which highly repetitive work is done, requires only a brief training period. "Learners" (either men without previous foundry experience or upgraded foundry helpers) are assigned to work with a molder engaged in making a particular kind of mold. After 2 to 6 months of this training, the learner is usually competent to make the same mold, or one that is roughly similar, on his own responsibility.

Machine molding jobs of the more difficult and responsible types also require formal or equivalent training. However, machine molding of the less skilled variety, is ordinarily learned in 60 to 90 days of on-the-job training.

An eighth grade education is usually the minimum requirement for apprenticeship. Many employers specify additional education up to and including high school graduation. Eighth grade schooling, however, is sufficient for learners of less skilled hand molding or machine molding jobs.

Physical standards for molding jobs are fairly high. The molder stands at his work, moves about a good deal and must do frequent lifting. The hand molder needs a high degree of manual dexterity and good vision. Since the work is fairly strenuous, very few women are employed as molders.

Employment Outlook

Little increase in employment of molders is expected during the 1960's. Replacement needs, however, will provide many opportunities for new workers to enter the trade.

The continuation in the trend toward more machine molding and less hand molding, and increasing use of permanent molds and shell molds, will result in a greater foundry output per molder employed. Thus, the expected large increase in foundry activity will result in little growth in the number of molders.

The need to replace molders who retire, die, or transfer to other fields of work will provide many opportunities for new workers to enter this occupation. Retirements and deaths alone will provide about 1,000 openings annually during the 1960's. There will be several hundred opportunities each year for young men to obtain molding apprenticeships leading to journeyman molding jobs. There will be even more openings for workers for entry jobs in machine molding and in the less skilled types of hand molding.

Earnings and Working Conditions

Molders are among the better paid foundry workers. In late 1958, molders were generally earning from $2.30 to $2.75 an hour depending upon locality and type of foundry.

Most molders are members of labor unions. Many of them have been organized by the International Molders and Foundry Workers Union of North America. Others are members of industrial unions such as the United Steelworkers of America, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

(See introductory section of this chapter for Where To Go for More Information.)

Coremakers

Nature of Work

Coremakers prepare the bodies of sand or "cores" which are placed in molds to form hollows or holes required in metal castings. The poured metal hardens around the core so that when the core is later removed, the desired cavity remains. A core may be made either by hand or machine. In both instances, prepared sand is packed into a core box, a block of wood or metal into which a hollow space of the size and shape of the desired core has been cut. After the core has been removed from the core box, it is hardened either by baking or by other drying methods. When hand methods are used to make a core, the coremaker uses mallets and other handtools to pack and ram sand into the core box.

In hand coremaking, small cores are made on the workbench by *bench coremakers* (D.O.T. 4-82.010) and bulky cores are made on the foundry floor by *floor coremakers* (D.O.T. 4-82.010). There is a wide range of skill requirements in this occupation. All-round hand coremakers (journeymen) prepare a variety of larger or more intricate cores. The less skilled coremakers make the smaller and simpler cores frequently produced in large numbers, so that the work is highly repetitive. Many skilled coremakers are employed as supervisors.

Machine coremakers (D.O.T. 6-82.010, .020, and .030) operate several different types of machines which force sand into specially shaped hollow forms to make the sand cores. Some machine coremakers are required to set up and adjust their own machines and do any necessary finishing operations on the cores. Other coremakers are primarily machine tenders. They are more closely supervised and the necessary adjusting of the machines is done for them. Machine coremakers are employed mainly in foundries where large quantities of identical castings are made.

Training and Other Qualifications

Completion of a 4-year apprenticeship or the equivalent in experience is needed to become a skilled hand coremaker. Coremaking apprenticeships are also sometimes required for the more difficult and responsible machine coremaking jobs. Coremaking and molding training are often combined in a single apprenticeship. The apprentice works with journeymen coremakers, first helping them in routine duties and then undertaking more advanced work, such as making simple cores, or operating core ovens. As his skill increases, the apprentice makes more complex cores. He acquires experience in benchwork and floorwork and in the operation of any coremaking machines used in the plant. On-the-job training is generally supplemented by classroom instruction covering such subjects as arithmetic, shop drawing, and the properties of metals. For the less skilled hand coremaking and for most machine coremaking jobs, only a brief period of on-the-job training is needed. An eighth grade education is usually a minimum for coremaking apprentices; some employers require that apprentices be high school graduates.

Persons without previous foundry experience may be hired directly for the less skilled coremaking jobs, or foundry laborers or helpers may be upgraded to do this work. Physical requirements for light coremaking are not exacting because the work is not especially strenuous. Some

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Coremaker setting reinforcing wires in sand in a core box.

types of hand coremaking require a high degree of manual dexterity. Women are frequently employed to do light coremaking.

Employment Outlook

Only a moderate growth in the number of coremakers is expected in the 1960's. The continued trend toward a greater proportion of cores being produced by machine rather than by hand and the resulting greater output per worker will limit the growth in the number of coremakers.

Replacement needs, however, will provide some job opportunities for new workers to enter this occupation. The need to replace workers who retire or die will create about 500 job openings annually during the 1960's. Many other new workers will be needed to replace experienced coremakers who transfer to other fields of work.

Earnings and Working Conditions

Coremakers generally earn more than the average for foundry plant workers and for factory workers generally. In late 1958, coremakers were generally earning from $2.30 to $2.75 an hour, depending upon locality. Hand coremakers with all-round training have opportunities for promotion to supervisory jobs.

Most coremakers are members of labor unions. Many of them have been organized by the International Molders and Foundry Workers Union of North America. Others are members of industrial unions, such as the United Steelworkers of America, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

(See introductory section of this chapter for Where To Go for More Information.)

Patternmakers

Nature of Work

Patternmakers are the highly skilled craftsmen who build patterns and core boxes. In metal casting, these are the forms around which the molds and cores are formed. About half of the 15,000 in the occupation are *metal patternmakers* (D.O.T. 5–17.010). Nearly all of the others are *wood patternmakers* (D.O.T. 5–17.020). A small number work with other materials such as plaster.

A patternmaker works from blueprints and in planning the pattern, takes into consideration the casting method and the type of metal to be used.

The metal patternmaker prepares patterns from metal stock, or more commonly, from rough castings made from an original wood pattern. He uses a variety of metalworking machines, including the engine lathe, drill press, shaper, milling machine, power hacksaw, and grinder, to shape and finish the patterns.

The wood patternmaker selects the appropriate woodstock, lays out the pattern, marks the design for each section on the proper piece of wood, and saws each piece roughly to size. He then shapes the rough pieces into their final form, using various woodworking machines—such as lathes, planers, band saws, and sanders—as well as many small handtools. Finally, he assembles the pattern segments by hand using glue, screws, and nails.

Throughout his work, the patternmaker carefully checks each dimension of the pattern. A high degree of accuracy is required, since any imperfection in the pattern will be reproduced in the castings made from it. Other duties of patternmakers include making core boxes (in much the same manner as patterns are constructed) and repairing patterns and core boxes.

Patternmaking is done in specially equipped pattern shops. In late 1958 about half of the patternmakers worked in foundries. The other half worked in establishments that made patterns on order or in departments of plants that buy castings from a commercial foundry.

Training and Other Qualifications

Apprenticeship, or a similar program of on-the-job training, is the principal means of qualifying as a journeyman patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking, it is very difficult to obtain the necessary training by informally picking up the trade. However, in some instances skilled machinists have been able to transfer to metal patternmaking with ad-

Patternmaker using a gouge to carve a round corner in a wood pattern.

ditional on-the-job training or experience. Good trade school courses in patternmaking provide useful preparation for the prospective apprentice. Such courses may, in some cases, be credited toward completion of the apprenticeship period. However, these courses do not substitute for apprenticeship or other on-the-job training.

The usual apprenticeship period for patternmaking is 5 years. At least 720 hours of classroom instruction in related technical subjects is normally provided. There are separate apprenticeships for wood and metal patternmaking.

The patternmaker apprentice begins by helping journeymen in routine duties. Then he makes simple patterns under close supervision, gradually learning to use the various types of machines and handtools. As his training progresses, the work becomes increasingly complex and the supervision more general.

Patternmaking, although not strenuous, requires considerable standing and moving about. A high degree of manual dexterity is especially important because of the precise nature of many hand operations. The ability to visualize objects in three dimensions is also important. Employers generally require apprentices to have at least a high school education.

Employment Outlook

Little change in the number of patternmakers is expected in the 1960's. Despite the increase in foundry production, the number of patternmakers has not grown significantly for several decades. Mass production, which required the preparation of large numbers of identical castings, resulted in greater use of metal and plastic rather than wood patterns. The more durable metal patterns can be used many times in the making of identical molds and thus the number of individual patterns required for a given number of castings has declined.

However, replacement needs will provide job opportunities for new workers to be trained as patternmakers. It is estimated that about 500 new patternmakers will be needed annually in the 1960's to replace workers who retire, die, or transfer to other fields of work. Most of the job openings will be in metal patternmaking.

Because patternmakers learn either the basic metalworking or woodworking skills, they can find jobs in related fields when patternmaking employment is not available. Wood patternmakers can qualify for skilled woodworking jobs, such as cabinetmakers, and metal patternmakers can transfer their skills to machine shop jobs, such as machinists or layout men.

Earnings and Working Conditions

Patternmakers are one of the highest paid groups of skilled workers in manufacturing. In late 1958, most patternmakers earned between $3.30 and $3.90 an hour. Nearly all patternmakers are members of a labor union—the Pattern Makers' League of North America.

(See introductory section of this chapter for Where To Go for More Information.)

FORGE SHOP OCCUPATIONS

Forging is one of the five principal methods of shaping metal. The others are machining, casting, rolling, and stamping. Metal shaped by the forging process is unusually strong and resistant to strain. Some of the jobs required to produce forgings are found only in forge shops; this chapter deals primarily with these jobs.

Nature of Work

Forge shop workers use hammers and presses to shape heated pieces of metal into parts which must bear great stress. Among the items produced by the forging process are automobile crankshafts, gears, marine engine driveshafts, and aircraft and missile parts. At the beginning of the forging process, some workers heat metal in intensely hot furnaces so that it can be more easily shaped. Then, other workers manipulate the hot metal under the hammers and presses. Finally, trimmers, grinders, chippers, and other workers take off the rough edges and perform other finishing operations.

The forging process is similar to that used by the old-time blacksmith, except that machine power is substituted for the blacksmith's arm and dies replace his hammer and anvil. Open dies (which are generally flat) are used to produce relatively small numbers of forged parts. Closed dies, which have a cavity in the shape of the forging, are used where the need for large quantities of identical forgings (for example, automobile crankshafts) justifies their expense. These dies are made by highly skilled workers— known as *die sinkers* (D.O.T. 4–76.010)—who use machine tools and hand tools, such as files and chisels, to shape the die cavities.

The basic equipment used by forge shop workers consists of various types of power hammers and presses. Other forge shop workers use handtools such as tongs, wrenches, hammers, and measuring devices such as rules and calipers.

The principal forge shop jobs are concerned with the operation of forging hammers and presses. Crews, generally consisting of from 2 to 10 men, operate the forging equipment used to pound or press metal parts into shape. Operators and their helpers, on hammer and press crews, customarily specialize on a particular kind of equipment. Duties of some of the more important forge shop production jobs are described below:

Hammersmiths (D.O.T. 4–86.120) control steam hammers, equipped with open dies, that pound pieces of hot metal called blanks into particular shapes. The precision of these forged parts depends on the skill of the hammersmith. He interprets blueprints, drawings, or sketches to determine how to work the metal under the steam hammer. He directs a crew of assistants in the manipulation of the metal and controls the stroke of the steam hammer so that the piece being forged will be shaped to the customer's specifications. The hammersmith may also determine whether the metal being worked needs additional heating. During the forging process, he may also place various forming tools between the dies and the part being forged in order to make forgings of various simple shapes. His crew includes a hammer driver ("hammer runner"), a heater, a craneman, and one or more helpers.

Drop hammer operators (*or Hammermen*) (D.O.T. 4–86.110) operate forging equipment (drop hammers) which pounds heated metal into shape between closed dies. They must use special care to position the metal under the hammer. The level of skill required increases with the size of the hammer and the metal blanks and the complexity of the forging. A drop hammer operator supervises the helpers and heaters assigned to him. He may set the dies in the hammer or supervise his crew in performing this work.

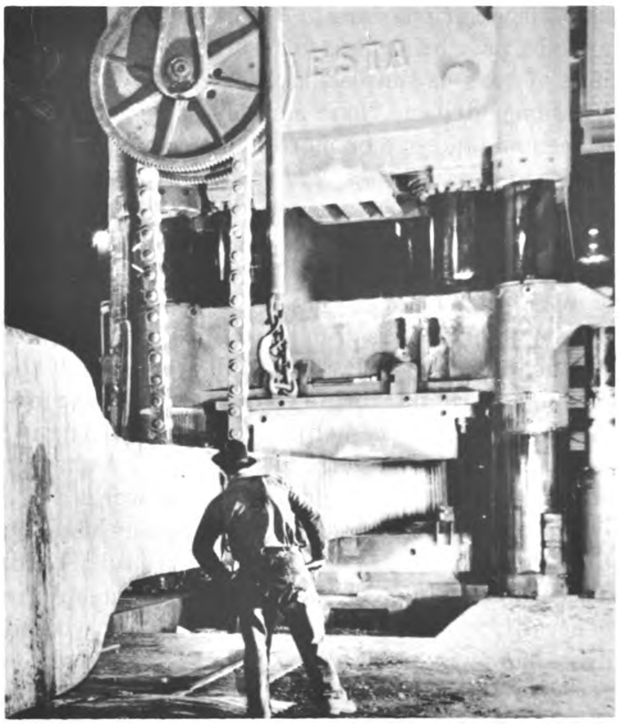
The principal types of drop hammers used by these operators are steam or air and board. Those operating steam or air drop hammers are generally considered more skilled than board drop hammer operators, because they control the force of the forging blow, which is uniform on the board hammer.

Forging press operators (D.O.T. 4–86.125) work on either huge mechanical or hydraulic forging presses which shape hot metal blanks by squeezing them between either open or closed dies. The skills of operators in open die forging press work are similar to those of hammersmiths, because both groups of workers manipulate metal blanks between two open dies. Closed die press operators work to more exacting specifications than open die press operators but do not need the manipulating skill of the open die forging press operators.

On the large presses, the open die forging press operator supervises a crew which may include an assistant operator, a craneman, and several helpers. The closed die press operator may supervise a smaller crew or he may work alone.

Both open and closed die press operators must know how to control the heating of metals, regulate the pressure of the machines they use, and position the work between the dies. Their duties may also include setting up the dies in the presses.

Upsettermen (D.O.T. 4–86.125) operate forging machines which apply pressure to hot metal being shaped between closed dies. Unlike forging presses and hammers which shape metal by applying force vertically, upset machines apply pressure horizontally. Among the duties of the upsettermen are the control of the heating operation, the adjustment of the machine's pressure on the metal, the alinement of the dies, and the positioning of the metal stock between the dies. A small crew consisting of a heater and helpers is often supervised by an upsetterman. Deep-socket wrenches, aircraft engine cylinders, bolts, and valves are some of the products made in large quantities on upset machines.



Press operator directing the forging of huge metal piece between open dies of a forging press.

Heaters (D.O.T. 4–88.081) control the supply of fuel and air in furnaces which heat different metals to the most suitable temperatures for forging. After the proper temperature has been reached, the heater may transport the metal to the forging equipment.

Inspectors (D.O.T. 4–86.162.) check semifinished and finished forgings for size, shape, quality, and other specifications by inspectors. Some inspectors examine forged pieces for flaws and faulty workmanship while the forgings are still hot. Others inspect forgings after they are trimmed to determine whether required standards have been met. Inspectors may use micrometers, calipers, or other measuring devices to determine whether forged parts meet exact specifications. Testing for flaws may also be done with strength and hardness testing machines, electronic testing devices, and other testing equipment.

A considerable number of forge shop workers are employed in cleaning and finishing operations. For example, *trimmers* (D.O.T. 6–88.717) remove excess metals from hot or cold finished forge pieces with presses equipped with trimming dies. *Chippers* use pneumatic hammers to remove imperfections from stock. *Grinders* remove rough edges from completed forgings with mechanically powered abrasive wheels. *Blasters* operate sandblasting or shotblasting equipment to clean and smooth forgings. *Picklers* dip forgings in an acid solution to remove scale. *Heat treaters* improve the physical properties of forgings by heating and cooling metals under controlled conditions. They may produce specified degrees of hardness and strength by cooling the metal parts in the air or by quenching them in baths of water, oil, or brine.

Location of Forge Shop Work

Independent steel forging shops, which produce forgings for sale to other users, employed about 60 percent of the approximately 60,000 forge shop workers in mid-1958. The remainder were employed in the forge shop departments of automobile, steel mills, farm machinery, handtool, structural and ornamental, and other types of plants which use forgings in their final products; railroads also employed forge shop workers.

Employment of forge shop workers is concentrated primarily in the metalworking centers. Ohio, Illinois, Michigan, Pennsylvania, Wisconsin, and New York are among the principal centers of forge shop employment. Forge shops are located near the steel producing centers which provide steel for forgings as well as near the metalworking plants which are the major users of forged products.

Training, Other Qualifications, and Advancement

Most forge shop workers learn their skills through on-the-job training and work experience. As they acquire experience and skills they progress from the simple to the more difficult jobs. Advancement to the skilled job of hammersmith, for example, requires several years of on-the-job experience and training.

The basic entry job on hammer and press crews is that of helper. Employers usually require no more than an eighth-grade education for helpers and other workers in entry occupations, but high school graduates are given preference. Therefore, young men interested in preparing themselves for the more skilled forge shop jobs and for supervisory positions should continue their education and study such subjects as mathematics, drafting, and shopwork. After a worker has served as a helper in a hammer or press crew he may be upgraded to one of the more skilled jobs, such as heater, hammersmith, hammerman, or press operator.

A few companies offer apprenticeship training programs for the more skilled forge shop jobs, such as die sinker, heat treater, hammersmith, hammerman, and press operator. Their programs generally last 4 years and provide 8,000 hours of varied training. The die sinker apprenticeship varies from 4 to 8 years depending on the particular area or shop. During the apprenticeship program the trainee learns to use the tools of the trade in addition to studying related subject matter. For example, hammersmith apprentices learn how to operate hammers and furnaces and how to use handtools. They also learn about the properties of metals, how to read blueprints, and to weld.

Training requirements for inspectors vary. Inspectors who visually inspect the rough forgings, using simple gages, can usually perform their jobs after a training period lasting only a few weeks. However, inspectors who examine forgings manufactured to exact specifications are required to have some technical background in blueprint reading and mathematics. They may also need several months of on-the-job training before they can operate the more complicated testing equipment.

Employment Outlook

The long-run prospects for forge shop jobs are for a moderate growth during the 1960's. New jobs will be created as a result of the anticipated expansion in the metalworking industries which use forged parts in their final products—particularly the aircraft and missile, industrial machinery, and automobile industries.

Developments taking place in recent years indicate a wider application of the forging method to produce metal parts. On the other hand, the use of castings to replace some forged parts in automobile manufacturing and the continuing mechanization of the forging process may limit somewhat the growth of employment in forge shop occupations. Mechanization may primarily affect the employment of helpers since the latest mechanical developments in the forging process are designed to reduce the amount of less skilled work in forging operations. Mechanization is expected to have little effect upon the need for skilled hammersmiths and forge-press operators because machines cannot be easily substituted for the skill and experience of these workers.

In addition to job openings resulting from increased activity in forge shop operations, job opportunities will arise from the need to replace those workers who leave the forge shops because of retirements, deaths, and transfers to other fields of work. Retirements and deaths alone should result in about 15,000 job openings in forge shop occupations during the 1960–70 decade.

Earnings and Working Conditions

Forge shop workers are among the highest paid factory workers. In April 1959, production workers (including unskilled and semiskilled workers as well as skilled craftsmen) in independent iron and steel forging plants averaged $115.59 a week and $2.84 an hour. Production workers in all manufacturing industries averaged $89.87 a week and $2.23 an hour in the same month.

In many forge shops, the base hourly rates of individual hammer or press crew members are increased by incentive earnings based on the total production of the crew. This method of wage payment is a factor in the level of forge shop earnings. An examination of a number of union-management contracts shows that the highest paid forge shop workers are the skilled hammersmiths, press operators, drop hammer operators, and die sinkers. In mid-1958, they were generally receiving between $3 and $4 an hour, with the workers who use the largest equpment receiving the highest pay.

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America, the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America, and the International Association of Machinists. Many of the plants which employ forge shop workers have union-management contracts which provide insurance and pension plans, and other nonwage benefits.

Although forge shops typically are hot and noisy, and much of the work is strenuous, working conditions have been improved in recent years. Many firms have installed large ventilating fans and have attempted to reduce machine concussion and vibration.

The injury-frequency rate in forge shops is higher than in many other types of factory work, but it has been declining in recent years because of the greater emphasis upon safety precautions. Forge shop firms and the unions have contributed to the reduction of accidents in forge shops by promoting the greater use of protective goggles, metal-toe shoes, metal helmets, and safety guards at the machines.

Where To Go for More Information

Drop Forging Association, 1121 Illuminating Bldg., 55 Public Square, Cleveland, Ohio

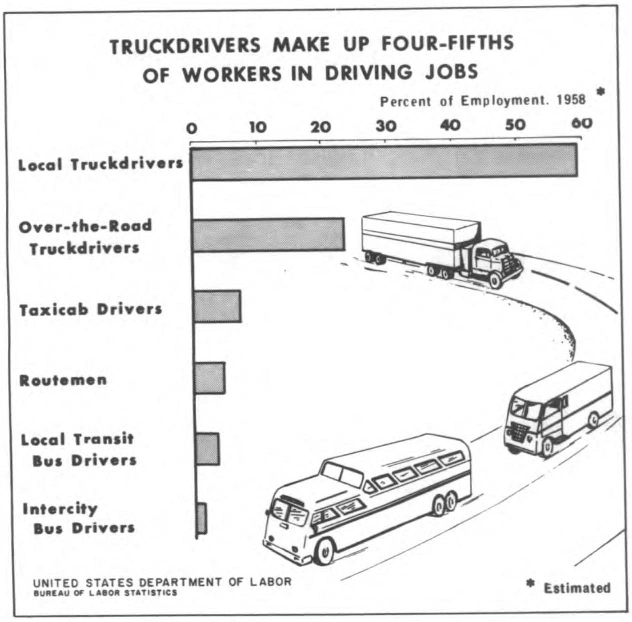
International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 570 New Brotherhood Bldg., Kansas City 11, Kans.

DRIVING OCCUPATIONS

One out of every 20 American workers earned his living by driving a truck, bus, or taxicab in 1958. These 2¼ million men played a vital role in moving passengers and goods over miles of highways and city streets. (See chart 31 for employment by individual occupation.) They transported the food and thousands of other products used in our homes, schools, and factories. They also transported millions of Americans to and from work every day.

Some of them, like the over-the-road truckdriver, the intercity bus driver, the local bus driver, and the taxicab driver, spend practically all of their working time in driving. Others, like the local truckdriver and delivery man, spend considerable time in loading and unloading goods, making pickups and deliveries, and collecting money. Still others, like the routeman, spend a good deal of their time selling.

CHART 31



Many driving jobs require a high degree of responsibility. Drivers, for the most part, operate large and expensive equipment which they must drive carefully, obeying safety regulations and traffic laws, to deliver their passengers and freight safely. These men are on their own, away from direct and close supervision.

Although employment in some driving jobs is not expected to increase substantially during the next decade, a large expansion in the employment of local and over-the-road truckdrivers is anticipated as a result of increased freight tonnage. Normal turnover in this large occupational field will also provide many job opportunities each year during the 1960's.

For young men who are not planning to attend college and who have no interest in or aptitude for the skilled technical occupations, these jobs offer excellent opportunities. The pay of most drivers is relatively high and working conditions are fairly good. Many young men will also enjoy the freedom from close supervision as well as the frequent contacts with people, which is characteristic of most of these jobs.

Over-the-Road Truckdrivers

(D.O.T. 7–36.240)

Nature of Work

The men at the wheels of the big trucks seen on our highways and turnpikes are the top professional drivers in the country. These men drive the largest and most expensive equipment and receive the highest wages of all drivers. They are on their own practically all the time and have a great deal of responsibility.

Most over-the-road drivers operate gasoline or diesel powered tractor-trailers. (The tractor is the truck with the very short chassis which draws the trailer in which the freight is carried.) They deliver goods usually over long distances—frequently driving at night.

Unlike the local truckdriver who spends considerable time in loading and unloading, the over-the-road driver (sometimes called intercity

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driver, line-haul driver, or long-haul driver) spends practically all of his working time in driving. He may, however, sometimes handle the freight he carries. Some drivers, for example, may have to unload their goods because they make deliveries to stores at night when there are no receiving crews on hand. Drivers of long-distance moving vans generally have to load or unload their vehicles, with the assistance of helpers obtained locally.

The truckdriver must back up big trailers to loading platforms. This requires the ability to maneuver the trailers while driving in reverse. The driver must also be able to judge distances accurately while driving around corners or driving through narrow passageways.

Because the over-the-road truckdriver spends most of his time driving, safe driving practices and courtesy are of the utmost importance. Every one has seen the emergency warning signals set out by a driver near his disabled truck on the edge of the highway. Many motorists have noted the courtesy of truckdrivers who pull off to the shoulder of the road at the top of a hill to allow the accumulated traffic to pass.

The long-haul truckdriver has a responsible job which also requires initiative. He is entirely on his own for long periods of time, transporting goods and materials of great value which must be delivered safely and on time.

Interstate Commerce Commission regulations require drivers to inspect their trucks before and after trips and make out reports on the condition of the vehicles at the end of the run. Drivers are also required to keep a daily log of their activities. If a driver has an accident, he must make out a detailed report.

Where Employed

The more than one-half million over-the-road driving jobs are scattered through the United States. Many of the jobs are located in some of the large cities, such as Chicago and Los Angeles; however, some large companies have their operating headquarters in fairly small towns.

Over-the-road driving jobs are fairly evenly divided between private and for-hire carriers. Private carriers are companies such as chain food stores or manufacturing plants which use trucks to transport their own goods. For-hire carriers are either common carriers (trucking companies serving the general public) or contract carriers (trucking firms hauling goods under contract only for certain companies). Most of the drivers of the big tractor-trailer combinations on long intercity runs are employed by common carriers. On shorter hauls, many drivers are employed by contract or common carriers to make deliveries of machinery, food, petroleum products, household appliances, and other items, from plants to warehouses and from warehouses to some large volume purchasers.

Qualifications, Training, and Advancement

Regulations of the Interstate Commerce Commission establish minimum qualifications which over-the-road drivers must meet. The driver must be at least 21 years of age, able bodied, with good hearing and vision of at least 20/40 with or without glasses. He must be able to read and speak English, have at least one year's driving experience (which may include driving

Over-the-road truckdriver checking light and air line connections before starting trip.

private automoblies), and a good driving record. Most States require truckdrivers to have a chauffeur's license, which is a commercial driving permit obtained from State Motor Vehicle Departments.

These are minimum standards which apply to all over-the-road drivers. Most fleet operators, however, have higher standards. Many firms will not hire drivers below the age of 25. Some employers have height and weight limitations. Many require applicants to have at least a grade school education; others require 2 years of high school. Some companies will employ only an applicant who has had several years of experience in handling vehicles of the type he would be required to drive.

The standards for over-the-road drivers are higher than those which generally prevail for local truckdrivers. Furthermore, these standards are more strictly adhered to than those for local drivers, which frequently may be lowered in the face of a tight labor market.

The truck-trailer combination seen on our highways probably costs as much as $20,000 and the load inside may be worth more than $100,000. The owners of this equipment, therefore, employ drivers with a know-how based on years of driving experience who can accept great responsibility.

Many training authorities and employers recommend that young men interested in becoming professional drivers would do well to take the driver-training courses offered by many of the Nation's high schools. If such a high school course is not available, the professional driving schools which operate in most large cities are recommended. A high school course in automotive mechanics is also very helpful.

Most long-haul drivers have had experience in local trucking. Usually they have entered this occupation by first driving a small, light truck. After gaining experience they have moved on to the larger and more complicated trucks. A young man may also begin as a helper to a local truckdriver and assist him in loading and unloading the truck. He may occasionally do some driving to relieve the driver.

Another type of experience considered very desirable by employers is a combination of intercity bus and local truck driving. This experience may be gained by working for an intercity bus company for the spring and summer months and by working for a local trucking company during the fall and winter months delivering such products as fuel oil. Thus, the driver gets the road experience with the bus company and learns how to handle a truck and trailer with the local trucking company.

All employers are interested in obtaining good, safe, reliable drivers, but the methods of selection and training vary. Some companies have formal tests and training programs. Other companies do their hiring on the basis of personal interviews and their training program consists of a "break-in" period during which the new employee observes and works with an experienced driver.

Applicants for jobs as over-the-road drivers are required to pass a physical examination which is usually paid for by the employer. Many firms also give written traffic and driving knowledge tests. Some employers give tests to measure such factors as reaction time, vision acuity and field of vision, the ability to judge speed, and emotional stability.

The last step in the selection of drivers is the road test. The applicant is expected to demonstrate his ability to handle, under a variety of driving conditions, a vehicle of the type and size he will operate in regular service.

A new driver may be given a brief indoctrination course. Company policy is explained and the new employee is taught how to prepare the various forms he will use on the job. The new driver will then make one or more training trips with an instructor or an experienced driver.

Drivers employed by common carriers frequently start on the "extra board" bidding for regular runs on the basis of seniority as vacancies occur. (The extra board is a list of men, assigned in rotation, who substitute for regular drivers or who make extra trips when necessary.) Drivers for private carriers are more likely to begin with assigned regular routes.

Promotional opportunities in this occupation are limited. A few drivers may advance to jobs as safety supervisors, driver supervisors, and dispatchers. Most drivers, however, can only expect runs which will give them higher earnings.

Employment Outlook

A very substantial increase in the employment of over-the-road truckdrivers is anticipated during the 1960's as a result of increased industrial activity, a continuation of the decentralization of industry, and the movement of population to the suburbs. A large number of job openings will also be created by transfers from this field of work. Many long-haul truckdrivers often return to local truckdriving jobs. Several thousand additional openings will also result each year from retirements and deaths.

The freight carried by over-the-road trucks has been increasing as a result of the general economic growth of the Nation and because trucks have been hauling an increasing proportion of the total freight. Many factories, warehouses, and stores are being located at great distances from each other in suburban or semirural areas where rail facilities are nonexistent or extremely limited. Furthermore, the growth of chain stores and the trend in the building of plants, whose products are part of a highly integrated manufacturing operation, both require daily coordination of shipping which can be best handled by trucks.

Improvements in trailer design have also contributed to the expansion of over-the-road trucking. These advancements have made it possible to ship certain kinds of freight for longer distances by truck than was previously possible. For example, some refrigerated trailers now provide temperatures down to 20 degrees below zero, and new livestock trailers feature controlled ventilation, nonskid floors, and interior walls designed to avoid bruising and other injury to the animals. As a result of these, and other factors mentioned previously, a large part of the future increase in long-haul freight traffic will probably go by truck and thus expand the demand for over-the-road truckdrivers.

Some recent freight transportation innovations may limit somewhat the anticipated increase in trucking business and driver employment. For example, "piggyback," the movement of highway trailers on railroad flat cars, which saves the cost of driver, fuel, and tractor, appears to have promising prospects, but as yet has had little effect on the trucking business. The increasing use of trailer-carrying ships, recently introduced for the transportation of loaded trailers for long distances, could also adversely affect the employment of over-the-road truckdrivers. In any event, the effect of these innovations would be largely limited to the movement of those commodities where the time element is not too important.

It is also possible that the trucking business may undergo a considerable expansion without a corresponding increase in driver employment. State limitations on truck weight, size, and speed are being liberalized as a result of the construction of better highways. The movement of bigger loads at higher average speeds could result in a need for fewer drivers than would otherwise be required to move the tremendous increase of over-the-road tonnage anticipated during the 1960's.

The over-the-road driver has a better chance of remaining employed during business recessions than workers in many other occupations. Although the total tonnage moved declines, over-the-road trucking is less affected than other means of transportation. It gets a bigger share of the shrinking transportation business because manufacturers and merchants, unable to buy in large car lot quantities, can reduce inventories and still maintain their diversified stock with small daily shipments by truck.

Earnings and Working Conditions

Most over-the-road drivers earned well above \$100 a week in 1958. Drivers employed by class I common carriers (carriers with gross operating revenues of \$1 million or more a year) of general freight had average annual earning of \$6,886 in 1957, the most recent year for which such data are available. The rates paid to over-the-road drivers are fairly uniform because this is a highly unionized field and union contracts are generally master agreements covering all employers within a region—an area including a number of States. Furthermore, because drivers working under different contracts often travel the same routes, even the various regional contracts tend to be quite uniform. The earnings of an individual driver are affected by such factors as the mileage driven, the number of hours worked, the type of equipment driven or the weight of the loads carried, and the type of "run"—whether or not pickup or delivery enroute is required.

Drivers on the longer runs are generally paid on a mileage basis for the time spent in actual driving. For all other time during which the driver is required to be on duty, he is paid at an hourly rate. This includes waiting time, delay time due to breakdown of equipment or impassable highways, layover time (time spent at a terminal away from home beginning at some designated hour after his run ends), and time spent in making pickups or deliveries enroute. Regular drivers are usually assured minimum pay for a certain number of hours—generally 8 hours a day and 40 to 48 hours a week.

Some private carriers pay their drivers on the same basis as their other employees—a monthly, weekly, or daily wage. Generally, such a wage is for a specified number of hours and if the driver works beyond that he receives extra pay.

Interstate Commerce Commission regulations limit the hours of work of over-the-road drivers. No driver may be on duty for more than 70 hours in any 8-day period. A driver must be off duty for at least 8 hours after driving for 10 hours before he can drive again. Many drivers, particularly on the very long runs, work pretty close to the maximum permitted. A workweek of at least 50 hours is very common.

Most drivers receive six paid national holidays plus one or more State and local holidays. They also receive paid vacations, usually from 1 to 4 weeks depending upon their length of service. Health, insurance, and pension plans, usually paid for by the employers, are very common.

Over-the-road truckdrivers are often required to spend time away from home—particularly when they drive long runs. The driver often starts out in the evening and arrives at the terminal in the other city the following morning. There, the company provides lodging for him either in a company dormitory or a hotel. In the evening, he starts on his return trip and arrives at the home terminal the following morning. The driver may make two or three such round trips a week. If the trips are part of a relay operation, another driver is working a similar schedule starting from the other end of the run.

Some companies use two-man sleeper teams on their very long runs. One drives while the other sleeps in the little bunk behind the cab. The vehicle goes straight on through to the end of the run where there may or may not be a layover before the return trip. Two periods of resting or sleeping in a berth in the truck meet the ICC requirement of 8 hours off duty following 10 hours of driving. This means that the drivers may remain with the truck in some cases for over 100 hours.

Although earnings on a sleeper run are the highest in this field of work, few drivers stay with it very long. The work is very tiring and requires being away from family and friends for days and even weeks. However, many drivers come back to sleeper runs after they have had a rest or have done some relay driving for a while. The earnings of drivers of long-distance moving vans are also quite high, but their hours are long and the work is strenuous. They drive more miles than the average over-the-road driver and also work more hours in loading and unloading goods.

Largely due to intensive safety programs and drivers' skill, the accident rate in over-the-road trucking is surprisingly low. Injuries occur with less frequency than in other forms of motor transportation.

Driving the big over-the-road trucks does not involve the physical effort most people associate with truck driving. Sitting in one place for hours at a time, however, is tiring and the nervous strain of sustained driving at night is also fatiguing.

Most over-the-road drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers of private carriers belong to unions representing the plant employees of the company for which they work.

Local Truckdrivers

(D.O.T. 7–36.200 through .299)

Nature of Work

The food, clothing, and other products required by consumers are transported by trucks. The men who move these goods from terminals, warehouses, and factories to wholesalers, retailers, and consumers must be skilled drivers to avoid accidents on congested city streets. They must also be able to maneuver skillfully big trucks into tight parking spaces, through narrow alleys, and up to loading platforms. (Telephone linemen, repairmen, and many thousands of other workers who drive trucks only incidentally to their primary job duties are not included in this discussion.)

When the local truckdriver reports to work at the terminal or warehouse, he receives his assignment to make deliveries, pickups, or both. He also receives the delivery forms he will need and checks the condition of his truck. His truck is generally loaded for him by platform men. If he does the loading himself, however, and must make many deliveries, he arranges the items in proper sequence so that there will be a minimum of handling. At the customer's place of business the driver generally loads and unloads the merchandise himself. If he has heavy loads such as machinery or if he has many deliveries to make during the day, he may have a helper to assist him. The driver of a moving van usually has a crew of helpers to assist him in loading and unloading household or office furniture.

At the delivery points, the driver gets customers to sign receipts and freight bills, and he sometimes collects money for freight, C.O.D. deliveries, and other charges. At the end of his day, he turns in all receipts and cash collected and records his time and the deliveries made. He also reports whatever maintenance or repair is needed before his truck is used again.

Some of these workers drive special types of trucks, such as dump or oil trucks, which may require the operation of mechanical levers, pedals, or other equipment. For example, if they drive dump trucks, they operate levers inside the cab or at the side of the truck in order to set the dumping mechanism in motion. If they haul heavy machinery, they operate mechanical hoists to load and unload the machines.

Where Employed

About 1¼ million workers were employed as local truckdrivers in early 1958, mostly in and around large metropolitan areas. They work in all localities, however, including even the smallest villages.

A large majority of local drivers work for businesses which distribute their own products and materials—such as department stores, meatpackers and other food processors, wholesale distributors, petroleum companies, grocery chains, and construction companies. Many others are employed by local *for-hire operators*—trucking companies which serve the general public or specific companies under contract. Some other truckdrivers are employed by the Federal Government and by States and municipalities. A large number of local drivers are in business for themselves.

Qualifications, Training, and Advancement

Qualifications for local truckdrivers vary considerably, depending upon such factors as the type of equipment to be operated and the nature of the employer's business. Generally, applicants must be 21 years of age or older. Some employers prefer applicants who have completed grade school or had 2 to 4 years of high school. The applicant must be physically able to lift heavy objects and otherwise be in good health. He

Local truckdriver and helper picking up freight at customer's warehouse.

should have good hearing and vision (with or without glasses). Since a driver often deals directly with the public, employers look for men who are tactful and courteous.

An applicant usually must get a chauffeur's license, which is a commercial driving permit. Familiarity with traffic laws and safety measures is necessary, and some previous experience in driving a truck is helpful. A young man may obtain such experience by working as a truckdriver's helper. Employers also give consideration to experience gained in the Armed Forces.

Since he will be responsible for costly vehicles and cargo, a truckdriver must be cautious, alert, and able to judge distances and to coordinate his reactions so as to avoid accidents in congested traffic. To demonstrate these qualifications, an applicant's driving alibity will be tested, and he may have to pass a written examination, as well as a general physical examination.

Training given to a new driver is often informal and may consist only of riding with and observing an experienced driver on the job. If he is to drive a special type of truck, the new driver may be given additional training. In some companies, a new driver is given a brief indoctrination course which lasts 1 or 2 days. This instruction covers his general duties, the efficient operation and loading of his truck, company policies, and the preparation of delivery forms and company records.

Although most new employees are immediately assigned to regular driving jobs, some start as extra drivers. These drivers take over the routes of regular drivers who are ill or on vacation, or make extra trips when necessary. They receive regular assignments when openings occur.

Local truckdrivers may get jobs as dispatchers or advances to jobs as terminal managers, or supervisors. However, these jobs are relatively few. For the most part, advancement for a local truckdriver consists of earnipg higher hourly wages by driving heavy or special type trucks instead of light trucks, or by transferring to over-the-road truck driving.

An experienced truckdriver who has some business ability and ambition can start his own trucking company when he has sufficient capital to purchase expensive trucking equipment. Truckers who own only one or two vehicles continue to account for a sizable proportion of local for-hire trucking business.

Employment Outlook

A moderate rise in the employment of local truckdrivers is anticipated during the next decade because of the expected increased volume of freight. Many new workers will also be needed to replace drivers who retire, die, or transfer to other fields of work. Retirements and deaths alone will result in about 10,000 to 15,000 job openings each year for local truckdrivers during the next few years.

The rise in total business activity anticipated between 1960 and 1970 will increase the volume of freight to be transported. Since trucks carry virtually all freight for local distribution and do not face competition from other types of carriers, this anticipated increase in total intercity and local freight volume will expand local trucking business and, thereby, truckdriver employment. Another factor that will contribute to the employment of more drivers is the continued growth of suburban areas.

Some recent developments may offset somewhat the employment gains that would otherwise occur with an increase in freight volume. For example, the overall growth in local truckdriving jobs may be reduced by the current trend of larger deliveries to relatively fewer customers resulting from the growth of chain stores and shopping centers. The introduction of new equipment may also affect the number of drivers who will be needed to deliver large and heavy loads. For example, the greater use of trucks equipped with power tailgates that can be raised or lowered to platform or ground level will reduce the time needed by each driver to make his deliveries. Innovation in local trucking will continue to be limited, however, by narrow city streets and heavy traffic.

Earnings and Working Conditions

On the average, minimum union wage scales were $2.44 an hour for local truckdrivers and $2.18 an hour for driver-helpers on July 1, 1958—according to a survey conducted by the Bureau of Labor Statistics in 52 cities of over 100,000 population. The city averages of the minimum pay scales for drivers ranged from $1.91 in New Orleans to $2.64 in the San Francisco-Oakland area. (See table.) Wage rates vary even in the same city depending on the type of trucking service (such as general freight drayage or local moving and storage), the type of product hauled, and the size and type of truck operated.

As a rule, local truckdrivers are paid by the hour and receive extra pay for working overtime, usually after 40 hours. Some drivers are guaranteed minimum daily or weekly earnings. Local truckdrivers frequently work 48 hours or more a week, which often requires them to drive on the 6th day. Night or early morning hauling is sometimes necessary, but daytime work is more customary. Some drivers are assigned different routes when they report to work each day. Others, however, deliver over regular routes or runs.

Local truckdrivers generally receive paid vacations of 1 or 2 weeks after a year of service and up to 4 weeks after 20 to 25 years. In addition, they usually receive six national holidays plus one or more State and local holidays.

Practically all unionized local truckdrivers and their helpers are covered by health, insurance, and pension plans, which are generally paid for by the employer. When uniforms are required, the cost is usually paid for entirely or partly by the employer, who may also provide for their upkeep.

Local truckdrivers, because they drive in heavy traffic through narrow city streets, are subject to nervous strain. The actual operation of a truck is not physically demanding, but when local drivers make many deliveries during a day, their work can be exhausting. Some drivers may develop physical disorders, such as back strains and hernias. One of the advantages of this job is that, for the most part, local drivers enjoy steady employment. Furthermore, unlike over-the-road drivers, they usually work a regular daytime schedule and return home in the evenings.

A majority of local truckdrivers belong to unions. Most of them belong to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.). Some local truckdrivers employed by private carriers are members of unions representing the plant workers of their employers.

Average union hourly wage rates for local truckdrivers in 52 cities, July 1, 1958

City	Average hourly rate	City	Average hourly rate
52-city average	$2.44	Memphis, Tenn	$2.27
		Milwaukee, Wis	2.51
Atlanta, Ga	$2.35	Minneapolis–St. Paul, Minn	2.42
Baltimore, Md	2.22	Newark, N.J	2.52
Birmingham, Ala	2.27	New Haven, Conn	2.33
Boston, Mass	2.31	New Orleans, La	1.91
Buffalo, N.Y	2.42	New York, N.Y	2.48
Charlotte, N.C	2.09	Oklahoma City, Okla	2.20
Chicago, Ill	2.55	Omaha, Nebr	2.36
Cincinnati, Ohio	2.47	Peoria, Ill	2.55
Cleveland, Ohio	2.58	Philadelphia, Pa	2.38
Columbus, Ohio	2.51	Pittsburgh, Pa	2.55
Dallas, Tex	2.32	Portland, Oreg	2.40
Dayton, Ohio	2.49	Providence, R.I	2.29
Denver, Colo	2.19	Richmond, Va	2.07
Des Moines, Iowa	2.28	Rochester, N.Y	2.36
Detroit, Mich	2.58	St. Louis Mo	2.49
Erie, Pa	2.36	Salt Lake City, Utah	1.94
Grand Rapids, Mich	2.44	San Antonio, Tex	2.41
Houston, Tex	2.17	San Francisco-Oakland, Calif	2.64
Indianapolis, Ind	2.42	Scranton, Pa	2.14
Jacksonville, Fla	2.39	Seattle, Wash	2.55
Kansas City, Mo	2.36	Spokane, Wash	2.47
Knoxville, Tenn	2.33	Springfield, Mass	2.33
Little Rock, Ark	2.18	Syracuse, N.Y	2.29
Los Angeles, Calif	2.53	Toledo, Ohio	2.42
Louisville, Ky	2.39	Washington, D.C	1.96

Routemen

(D.O.T. 7–35.100)

Nature of Work

Routemen are as much salesmen as they are drivers. In fact, they are sometimes known as driver-salesmen or route-salesmen. Once they are assigned to their routes, they must, through their selling ability, increase sales to existing customers and obtain new business by canvassing potential customers within their territories. Routemen drive panel or light trucks over an assigned route selling and delivering goods or services either to retail establishments or directly to the public. For instance, routemen employed by dry-cleaning establishments may pick up soiled clothing and laundry at customers' homes and deliver the processed articles (retail routemen); others, employed by bakery firms, may deliver bread and related products to retail grocery stores (wholesale routemen).

Before starting on his daily route, the routeman loads or supervises the loading of his truck. The amount of merchandise in his truck is generally checked by another employee. Some routemen deliver merchandise previously ordered and obtain orders for future delivery. Others make immediate sales from the stock in the truck. In either case, they must collect payments and keep records of their transactions. When they check in at the plant after completing their routes, they empty their truck and turn in their collections to the cashier. Those who have retail routes serving homes make from 5 to 10 times as many stops as the wholesale routemen who serve stores and other business establishments.

The work performed by routemen varies according to the industry in which they are employed, the type of routes they have (retail or wholesale), and the company employing them. Some specific examples, however, may indicate in a general way what most routemen do.

A typical day for a dry-cleaning routeman begins when he picks up cleaned garments at the processing plant and loads his truck, which is equipped with carrying racks. He delivers the garments to homes or business establishments and picks up soiled clothing. He marks the articles picked up so they may be identified upon his return to the plant. Sometimes, he makes notes of the types of stains or of special processes to be used, such as waterproofing. Each cleaned garment has an itemized bill attached, so that the routeman can collect the proper amount of money due.

Although all routemen must be able to get along well with people, it is particularly important in the case of the dry-cleaning routeman. His reaction to complaints and requests for special services may be the difference between increasing business or losing customers. Periodically, he calls on homes and businesses along his route which are not using his service to try to get their trade.

A good example of a wholesale routeman is the man who delivers bakery products to grocery stores. His truck is loaded the night before or early in the morning, and he checks to see whether he has the proper variety and quantity of products before starting on his route. He stops at from 10 to 50 grocery stores. At each stop, he brings the bread and other bakery products into the store and arranges them on the display racks, in the best possible display space he can secure. Together with the store owner or manager he checks the merchandise left. He then credits the store for the value of the stale bread and cakes left over from the previous delivery.

The routeman prepares a list of products he plans to deliver the next day. This represents his estimate of the amount of bakery products that will be sold by the grocery stores on his route. From time to time, he calls on grocers along his route, who are not his customers, and tries to get orders from them.

Where Employed

Over 100,000 routemen worked for a wide variety of businesses in 1958. Since most routemen were employed by companies which distributed food products or provided personal services, they worked in small towns as well as in large cities throughout the country. The greatest concentration of employment, however, was in the dairies, bakeries, and laundry and dry cleaning plants, located in the large cities.

Some routemen were engaged in wholesale distribution to stores and other business establishments, while others distributed goods and services

Routeman taking an order for dairy products.

to home owners and apartment dwellers. Many companies employed both wholesale and retail routemen.

Qualifications, Training, and Advancement

A routeman must have selling ability; this means he must have a genuine liking for people and must be tactful. He should be able to speak well and have a pleasant voice, neat appearance, poise, and self-confidence. He must have a thorough knowledge of the product or service he is selling and a persuasive personality to induce people to buy it. He also needs to have initiative and to be decisive to close the sale.

In addition to having selling ability, a routeman must be able to drive a truck, work without direct supervision, do simple arithmetic, and write legibly. In most States, a routeman is required to have a chauffeur's license, which is a commercial type driving permit. Information regarding this license can be obtained from State Motor Vehicle Departments.

Most employers require their routemen to be high school graduates, preferably 25 years of age or older. Many of the large companies give applicants aptitude and other psychological tests to determine whether they will make good salesmen and safe drivers.

High school courses in salesmanship, public speaking, driver-training, bookkeeping, business arithmetic, and distributive education are helpful to a person interested in entering this occupation. In the years immediately following high school, a young man interested in preparing himself for this occupation may obtain valuable experience as a sales clerk in a store or in some other type of selling job.

Another method of entering this occupation is to get a job as a *routeman helper* (D.O.T. 9–35.10). Employers usually hire boys 18 years of age or over who have a driver's license for this job. The helper assists the routeman by loading the truck at the beginning of the day, and runs deliveries from the truck to the customer's home or store. He may collect payments or obtain receipts, and may sometimes drive to relieve the routeman. Still another way of becoming a routeman is to get a job (plant or office) in a bakery, dairy, laundry, or dry-cleaning establishment. After learning something about the business, a young man may get a job as a routeman when an opening occurs.

Most companies give on-the-job training which varies in length and thoroughness. Many of the large companies have classes in salesmanship. Some companies assign newly hired routemen for brief periods to jobs in the different departments of the plant to familiarize them with all the processing operations, so they can answer customers' questions intelligently and be better salesmen. New employees are then trained for a short time on routes with supervisors. The first week, the routemen usually observe and assist the supervisors; later, they take over the operation under the direction of the supervisors.

Routemen may be promoted to route foremen or sales supervisors, but these jobs are relatively scarce. For most routemen, advancement is limited to moving from a retail to a wholesale route where earnings are usually higher. However, some routemen obtain better sales jobs as a result of the experience gained in route selling.

Employment Outlook

The employment of routemen in the 1960's is expected to remain at approximately the current level. However, a few thousand opportunities for new workers to enter this occupation will occur each year as a result of retirements, deaths, and transfers to other fields of work.

Since 1940, the number of routemen has been declining despite increases in population, income, and consumer expenditures. During World War II, there were sharp reductions in the number of routemen, particularly in home delivery, because of a shortage of men and gasoline. Deliveries were made less frequently—a practice which was continued after the war. During the postwar period the introduction of larger home refrigerators caused a further decline in the home delivery of milk and dairy products.

The employment of routemen in wholesale routes has also been declining because individual manufacturers now produce a greater variety of products which cannot be adequately handled by routemen and because large supermarkets have been replacing the small neighborhood stores. Some manufacturers and wholesale food companies, in recent years, have replaced their routemen with salesmen who cover their territory by automobile. Then truckdrivers, rather than routemen, make the deliveries in large trucks.

The decline in the employment of routemen appears to have run its course. Any further effect of the factors previously mentioned will probably be counterbalanced by the continuing population shift to the suburbs with its demand for retail routemen, and by the continuing development of new products increasing the demand for wholesale routemen. New lines of frozen foods, for example, are always coming out. These lines are often introduced and marketed by routemen in the thousands of food stores throughout the country.

Earnings and Working Conditions

Most routemen are paid a salary plus a percentage of the sales or collections they make. Earnings vary considerably between industries and also between routemen in the same industry. To a considerable extent, the earnings of routemen may be determined by their selling ability and the amount of time they spend in canvassing. Wholesale routemen generally earn more than retail routemen because, although they receive a lower percentage of sales, they handle much larger quantities.

Although comprehensive earnings data for these workers are not available, some recent studies by a private organization indicate that early in 1957, beginning retail routemen generally earned between \$50 and \$90 a week; most wholesale routemen started with earnings between \$65 and \$100 a week. Experienced routemen earned considerably more. Bakery routemen generally earned between \$80 and \$135 a week, with those having very good routes earning much more. In 1958, in some of the larger cities on the East Coast, milkmen making home deliveries earned on the average of about \$120 a week; those with wholesale routes had average earnings of \$150–\$160 a week. The average earnings of dry-cleaning routemen ranged from \$45–\$55 a week in the Southeastern part of the country to about \$90 a week on the West Coast.

The number of hours worked by routemen vary considerably. Some routemen work only about 30 hours a week; others may work as much as 60 or more hours a week. It depends, to some extent, on whether the individual routeman has a well-established route or whether he is trying to build up a new one; whether he has a retail or a wholesale route; and how ambitious he is. In some cases, the hours of work are limited by union contract. The hours of routemen may also vary according to seasonal peaks and lows. During the spring cleaning season, for example, dry-cleaning routemen may work about 60 hours a week; whereas, in the dead of winter they may not work more than 30 hours a week.

Many companies require routemen to wear uniforms. Some employers pay for the uniform and for keeping them clean; others require the routemen to do so.

Most routemen receive paid vacations, generally ranging from 1 to 3 weeks, depending upon length of service, and six or more paid holidays a year. Many employers provide hospitalization and medical benefits. Some routemen are covered by pension plans.

The routeman is pretty much on his own. He does not work under strict supervision and, within certain broad limits, may decide how fast he will work and where and when he will have his lunch or rest period. This freedom of action, plus the daily meeting and dealing with different people on his route, appeals to many young men. On the other hand, a routeman has to make deliveries in bad weather, do a great deal of lifting and carrying, and climb up and down stairs. He may also have to work odd hours.

Many routemen, particularly those delivering bakery and dairy products, are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some routemen belong to the unions which represent the plant workers of their employer.

Intercity Bus Drivers

(D.O.T. 5–36.010)

Nature of Work

The drivers of the big buses which travel between the cities of our country are selected on the basis of their driving skill, emotional stability, and courtesy. A driver's duties generally begin when he takes charge of the bus at the terminal, garage, or on the highway. Before beginning his scheduled trip, the driver inspects the bus carefully at the terminal or garage. He checks the gasoline, oil, water, and tires; and makes certain that the bus is carrying safety equipment, such as fire extinguishers, first-aid kits, flags, and flares. The driver also picks up the tickets, change, report blanks, and other items needed for his trip. He receives a listing of the freight or mail he is to carry.

Unless the driver is to take over an already loaded bus on the highway from another driver, he moves his empty bus from the terminal or garage to the proper loading platform, where he takes on his passengers. He collects fares—tickets or cash—from the passengers as they board the bus, and announces the destination, route, time of arrival, and other information concerning the trip. The driver also loads or supervises the loading of baggage into the baggage compartment. He checks the loading plan so that the baggage may be unloaded at the proper destination with a minimum of effort.

The driver operates the bus carefully at speeds which will enable him to arrive at and leave regular bus stops according to established time schedules. On most runs, he also stops momentarily at other designated points to discharge or pick up passengers, and load or unload baggage wherever necessary. He announces regular stops, and rest or lunch stops. Before continuing the trip he counts the passengers to make certain all have reentered the bus. The driver also regulates lighting, heating, and ventilating equipment for the passengers' comfort. In case of an emergency, he is sometimes required to make minor road repairs such as changing tires. The driver generally receives extra pay when he makes these repairs.

Upon arriving at his final destination, the driver unloads or supervises the unloading of the remaining baggage and turns in the lists of the packages or mail carried. He prepares reports on mileage, time, and fares as required by company rules. He also keeps a log of hours as required by the Interstate Commerce Commission. The driver must make out a complete report in case of an accident or an unusual delay.

Where Employed

Approximately 27,000 intercity bus drivers were employed by about 1,700 bus companies in 1957. More than 60 percent (17,000) of these drivers worked for the 144 large class I intercity companies—those with annual revenues of over $200,000. Although most bus drivers work out of

Intercity bus driver taking baggage from passengers.

the major metropolitan areas, some are employed in smaller cities and towns.

Qualifications, Training, and Advancement

All intercity bus drivers are required to meet minimum age, health, and experience qualifications established by the Interstate Commerce Commission. The ICC minimum age requirement is 21 years. In addition, the applicant must be able bodied, have good hearing, and his eyesight must be at least 20/40 with or without glasses. He must have at least 1 year's driving experience (through all 4 seasons), he must be able to read and speak English, and he must have a good driving record.

Although many intercity bus companies use these standards for bus driver positions, the large companies have higher requirements. Most of these companies prefer applicants to be at least 23 years of age with a high school education or its equivalent. Applicants are often given comprehensive examinations to determine their driving skill, intelligence, temperament, and personality. Some of the large companies do not accept applicants who wear glasses.

Young persons interested in becoming bus drivers should have good foot, hand, and eye coordination; be able to judge distances accurately and react quickly. An even temperament and emotional stability are other important qualifications because bus drivers work under considerable tension when they operate these large vehicles in heavy and swiftly moving traffic. Since they represent their companies in dealing with passengers, bus drivers must also be courteous and tactful.

Although previous experience in the operation of a truck or bus is not required, it is preferred by some employers. In most States, the law requires that a trainee for a bus driver's job must either have or obtain a chauffeur's license, which is a commercial driving permit.

Most intercity bus companies conduct training courses for beginning drivers. These training programs, which usually last from 2 to 6 weeks, include both classroom and driving instruction. In the classroom, the trainee is instructed in company and Interstate Commerce Commission rules; State and municipal regulations; safe driving practices; rates, schedules, and timetables; and how to deal with the public. He is also taught how to keep clerical records, check supplies, inspect the bus, and make minor emergency repairs.

The trainee then rides with a regular driver to observe correct driving practices and other aspects of the job. He also makes trial runs, without passengers, to demonstrate his driving skill. After satisfactorily completing the training, which generally includes final driving and written examinations, the new driver begins a "break-in" period. During this period he makes, still under strict supervision, regularly scheduled trips with passengers.

New workers start out on the "extra board." This list consists of drivers who are given temporary assignments. While on the extra board the new driver may substitute for a regular driver who is ill or on vacation. He may also drive a second bus section or make an extra trip if necessary. Extra drivers may have to wait several years before they have the necessary seniority to bid for and receive a regular assignment.

Opportunities for promotion are generally somewhat limited, particularly in the small companies. An experienced driver may be promoted to a job as dispatcher, supervisor, sales representative, terminal manager, or regional manager. For most drivers, advancement consists of receiving better assignments as their seniority increases and, consequently, higher earnings.

Employment Outlook

The employment of intercity bus drivers is expected to increase moderately during the 1960's. This increase in employment will reverse the trend of the recent past. Additional workers, in this relatively small occupation, will be needed primarily because of the expected increase in intercity bus travel.

Between 1950 and 1956, the number of bus passenger miles, the number of passengers, and the number of buses all declined. The major cause of the decline in bus passenger traffic has been the rapid rise in the number of automobiles in the United States and their increasing use for intercity transportation. Between 1950 and 1956, the number of privately owned automobiles registered in the United States increased 35 percent, while the number of intercity passenger miles traveled by private automobile increased 53 percent from

403 billion to 618 billion. Another factor which has contributed to the decline of the intercity bus industry has been the rapid growth of the air transportation industry, which has offered some competition on long trips.

The factors which caused a decline in the intercity bus industry also affected the employment of bus drivers. In 1950, about 32,000 drivers were employed by the intercity bus industry; by 1956, employment had dropped to about 27,000. This decline in employment was caused not only by declining passenger traffic, but also by increased efficiency resulting from larger buses, better highways, improved scheduling, and generally more effective bus and bus driver utilization.

During the 1960's, the employment of intercity bus drivers is expected to increase moderately, reversing the downtrend of the 1946–56 decade. The growth in population and higher consumer incomes expected during the next decade should result in more travel. A good part of this travel is expected to be by bus since the proportion of intercity traffic carried by automobile is not likely to increase very much. Some of the other factors which are expected to make bus travel more attractive during the 1960's are: New and improved highways, which are expected to cut the scheduled running time of many buses; larger and more comfortable buses; and deluxe express buses offering hostess service, refreshments, and other conveniences. Touring and charter services, package express and first-class mail delivered by buses, which have become important sources of revenue in the past few years, are also expected to affect the bus industry favorably in the future. The further curtailment or elimination of railroad passenger service in many areas should also bring about an increase in intercity bus traffic.

Earnings and Working Conditions

Drivers (including extra men) employed by class I intercity bus companies, averaged $5,532 in 1957. Many regular drivers employed by these companies earned more than $7,000 a year in 1958.

The wages of intercity bus drivers are typically computed on a mileage basis. Rates ranged from about 7 to 10 cents a mile in 1958. Most regular drivers were guaranteed pay for either 160 miles or for 8 hours a day. For all work other than their regular assignment or "tour of duty," they receive additional pay.

Extra drivers are usually paid by the hour when they are on call, but not driving. They are paid the regular mileage rate when actually driving. Drivers usually start at a minimum rate and receive increases at intervals of 6 months or a year. The maximum rate is generally reached at the end of 2 years. Extra men generally earn slightly less than regular drivers but, if enough work is available, they may earn as much or more than regular drivers. Most extra drivers receive a weekly or bi-weekly guarantee either in minimum hours, mileage, or earnings. Trainees are usually paid a flat daily rate.

Most drivers who work for the large companies average between 32 and 36 hours a week. Work schedules may range from 6 to 11 hours a day and from 3½ to 6 days a week. For example, a driver on the run between Washington, D.C., and New York City may make one 10-hour round trip a day for 3 days a week, drive part way and return each day for 6 days, or have the run split in some other way.

Interstate Commerce Commission regulations limit the hours of work of intercity bus drivers. According to ICC regulations, intercity drivers may drive no more than 10 consecutive hours, after which they must have at least 8 hours off. Drivers are also limited to 70 hours of "on duty" time in an 8-day period. The on duty time is the period from the time the driver is required to report for work until the time he is relieved.

Most intercity bus drivers belong to the Amalgamated Association of Street, Electric Railway and Motor Coach Employees of America. The Brotherhood of Railroad Trainmen and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) have also organized intercity bus drivers in a few areas.

The labor-management contracts covering most intercity bus drivers provide for health, insurance, and pension plans which are usually financed jointly by the workers and their employers. Drivers are also given vacations with pay ranging from 1 to 4 weeks, depending on the company for which they work and their length of service. They also usually receive 6 paid holidays. When away from home terminals overnight, drivers generally receive subsistence pay. Drivers must usually pay for their own uniforms.

Although driving an intercity bus is not physically exhausting, the work is demanding and requires steady nerves. The bus driver is given a great deal of independence in the actual performance of his job and he is solely responsible for the safety of both the bus and its passengers. Many drivers enjoy working without direct supervision and take pride in assuming these responsibilities. Some drivers like the idea of meeting the public and enjoy the opportunity of traveling.

Among the less desirable aspects of this job are the weekend and holiday work and the necessity of occasionally spending a night away from home. Another unfavorable part of the job is that extra drivers are on call at all hours and may be required to work at any time on very short notice. In addition, drivers with little seniority may, in some cases, be laid off when business declines.

Where To Go for More Information

For information regarding job opportunities, a young man should apply to intercity bus companies or the local office of the State employment service. Information may also be obtained by writing to the National Association of Motor Bus Operators, 839 17th St. NW., Washington 6, D.C.

Local Transit Bus Drivers

(D.O.T. 5–36.010)

Nature of Work

Local bus drivers transport millions of Americans to and from work every day. These drivers follow definite time schedules and routes over city and suburban streets in order to get passengers to their destinations on time.

The local bus driver's workday begins when he reports to the terminal or garage where he is assigned his bus. He receives his change, tokens, transfers, passes, and any other items needed. Before starting the run, the driver is usually required to check the tires, brakes, and lights. Some companies also require him to check the water, oil, and gasoline.

On most runs, the driver makes regular stops every block or two, where he operates the controls of the bus doors to enable passengers to enter and leave the vehicle. As the passengers board the bus, the driver collects cash fares, tokens, tickets, or transfers, issues transfers and tokens, and makes change. The local bus driver often answers questions concerning schedules, routes, transfer points, and street numbers; he is sometimes required to call out the name of the street at each regular bus stop. The driver also regulates heating, ventilating, and lighting equipment to keep the passengers comfortable.

At the end of his day's run, the bus driver turns in a trip sheet which usually includes a record of fares received, trips made, and any delays in schedule. In case of accident, the driver must make out a comprehensive report on the nature and cause of the accident.

Where Employed

In 1957, about 75,000 bus drivers were employed by the local transit bus industry. Approximately one-fourth of the drivers worked in cities where the transit system was municipally owned, such as Boston, Chicago, Cleveland, Detroit, Los Angeles, New York, and San Francisco.

In addition to the bus drivers employed by the local transit bus industry, some local drivers work for charter and sightseeing lines and for companies which specialize in operating school buses. A few drivers are employed by the Federal, State, and local governments. Although many drivers work in major metropolitan areas such as New York, Chicago, and Detroit, bus drivers are employed in most communities throughout the Nation.

Qualifications, Training, and Advancement

Applicants for bus driver positions should be between the ages of 21 and 40, should be of average height and weight, and have good eyesight—

Local bus driver giving passenger route information.

with or without glasses. The applicant must be in good health, with no physical disabilities, and must be able to pass both the written and physical examinations given by most employers. He must be able to judge distances accurately; have good foot, hand, and eye coordination; and have quick reflexes. Because the driver often works under pressure and deals with many different personalities, an even temperament and emotional stability are important. Although educational requirements are not strict, many employers prefer applicants with a high school education or its equivalent.

A motor vehicle operator's permit and, generally, 1 or 2 years of driving experience on some type of motor vehicle are basic requirements. Most States require bus drivers to have a "chauffeur's license" which permits the holder to operate commercial motor vehicles. This license may be obtained either during or immediately after the driver's training period. Some employers prefer drivers who have had some experience operating a truck or bus. Because the applicants will eventually be transporting passengers and since an accident could involve serious injury to a large number of people, good driving records are essential. A serious traffic violation or accident which occurred while a vehicle was moving may disqualify an applicant.

Most local transit companies conduct training courses which may last several weeks and include both classroom and driving instructions. In the classrooom, the trainee is taught company rules, safety regulations, and safe driving practices. He is taught how to keep records, and how to deal tactfully and courteously with passengers.

The trainee makes several trips without passengers, under the direct supervision of an experienced driver. After he becomes familiar with the operation of the bus, the company's routes and other details of his work, he makes, under supervision, several trips over a regular run with passengers. At the conclusion of his training, the new driver is often required to pass a written and final driving examination before he goes out on a run.

After the driver passes the examinations, he is placed on the "extra" list. While on this list he takes over the runs of regular drivers who are ill or on vacation and also makes extra trips in the morning or evening rush hours. He remains on the extra list until he has the necessary seniority to "bid" for and obtain a regular run. It may take anywhere from several months to several years before he is assigned a regular run. He also may drive charter and sightseeing runs, and other extra runs such as special service buses for public meetings and sporting events.

Promotional opportunities from regular driving jobs are generally limited and slow. Experienced drivers may advance to jobs as instructors, dispatchers, road supervisors, and, on occasion, to executive positions. Promotion in municipally owned bus systems is usually by examination. The opportunities for advancement of most drivers are limited to assignment to more desirable runs which they receive only after acquiring sufficient seniority.

Employment Outlook

There will be a small number of opportunities for new workers to enter this occupation each year during the 1960's, even though a slight decline in the employment of local bus drivers is expected. These openings will result from the need to replace drivers who retire, die, or transfer to other fields of work. Retirements and deaths alone will account for more than 1,000 openings each year during the 1960–70 decade.

In recent years, there has been a considerable decline in the volume of passenger traffic handled by the local-transit bus industry (table 1). The main cause of this decline has been the rapid rise in the number of private automobiles and their increasing use for transportation in both urban and suburban areas. Another factor has been the rapid growth of suburban residential areas, most of which have a wide variety of stores, theaters, restaurants, and other services. Since most suburban commercial districts have good parking facilities and are easily accessible by automobile, many suburbanites have found it unnecessary to use public transportation for shopping or other activities in suburban areas. In addition, increasing traffic congestion and parking problems in most downtown sections have led to the decline of many central business districts. This has, in turn, resulted in the curtailment of downtown bus service between rush hours.

As local transit bus traffic declined steadily in recent years and bus schedules and routes were curtailed or entirely eliminated, the employment of bus drivers also declined. The comparatively slight decline in bus driver employment was due in part to the fact that transit companies are not completely free to curtail or eliminate unprofitable routes since they are usually regulated by municipal authorities.

Employment of local transit bus drivers is expected to continue to decline during the 1960's—but at a somewhat slower rate than during the 1950–60 decade. The continuing population shift to the suburbs will again be responsible for a moderate drop in employment. No sharp decline is expected because downtown traffic congestion and parking problems will continue to limit the use of automobiles in downtown areas. Factors which will slow the downward trend in bus driver employment are the replacement of streetcars by buses, and the increased need for school buses in the suburbs. An increase in the number of municipally owned companies might also favorably affect bus driver employment, since municipally owned companies, even more than privately owned companies, may provide service in the public interest on unprofitable routes.

TABLE 1. *Local transit bus industry: Revenue passengers, bus miles, and motor buses, 1950–57*

Year	Revenue passengers (millions)	Bus miles (millions)	Motor buses
1950	7, 681. 0	1, 895. 4	56, 820
1951	7, 438. 0	1, 893. 0	57, 660
1952	7, 125. 0	1, 877. 7	55, 980
1953	6, 593. 0	1, 819. 0	54, 700
1954	6, 045. 0	1, 760. 7	54, 000
1955	5, 734. 0	1, 709. 9	52, 400
1956	5, 568. 0	1, 680. 9	51, 400
1957	5, 438. 0	1, 648. 4	50, 800

SOURCE: Transit Fact Book, 1958 Edition, American Transit Association.

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Earnings and Working Conditions

Local transit bus drivers are usually paid by the hour, and earnings vary according to locality, length of service, size of company or city, and length and type of run. Minimum hourly wage scales set by union contracts for bus drivers in 52 large cities surveyed by the U.S. Department of Labor's Bureau of Labor Statistics averaged $2.20 an hour on July 1, 1958. For nearly three-fifths of the bus drivers covered by the contracts, scales ranged from $2.10 to $2.35 an hour. Hourly scales were highest in the Great Lakes, Pacific, New England, and Middle Atlantic regions. Among the cities surveyed, the scales for experienced bus drivers ranged from $1.57 an hour in Charlotte, N.C., to $2.46 in Chicago, Ill. Wage scales for beginning drivers were generally 5 to 15 cents an hour less (table 2).

Most bus drivers have a standard work schedule of 8 hours a day, 40 hours a week. For additional work, drivers usually receive one and one-half times their hourly rates. In many companies, because of scheduling problems, drivers often work in excess of their standard work schedule, thereby increasing their weekly earnings. Drivers on the extra list usually work fewer hours and earn less money than those with regular runs. However, extra workers generally are guaranteed a minimum number of hours of work or a minimum weekly salary.

The workweek for regular drivers usually consists of any 5 consecutive days, with Saturdays and Sundays being counted as regular workdays. All transit companies run some buses in the evening and some companies operate 24 hours a day. Therefore, many drivers have to work at night.

Many drivers have regular "straight" runs which are unbroken except for meal periods and end-of-run rest periods. Others may work the "swing" run, in which the operator drives for several hours, is off for an hour or two, and then drives again for several hours. If the total elapsed time between the beginning and end of a split shift exceeds a stated number of hours, the driver generally receives extra pay.

Nearly all local transit bus drivers are covered by labor-management contracts which provide for health, insurance, and pension plans, typically financed jointly by the workers and their employers. Some of these plans, however, are paid for solely by the employer. Drivers also are given vacations with pay ranging from 1 to 4 weeks, depending on the length of service, and usually six or seven paid holidays a year.

Although driving a bus is not physically exhausting, bus drivers are exposed to the nervous tension which arises from driving a large vehicle on heavily congested streets and dealing with many types of passengers. In addition to driving a bus, they must collect fares, answer questions, see that passengers are clear of the doors, and request riders to move to the rear.

Among the more favorable aspects of this job is the steady year-round employment once a driver receives a regular assignment. Bus drivers are usually free of direct supervision—which many drivers also find desirable. Some drivers take pride in being solely responsible for the safety of the bus and its passengers and in acting as the bus company's representative to the general public.

Most bus drivers are members of the Amalgamated Association of Street, Electric Railway and Motor Coach Employes of America. Drivers

TABLE 2. *Union scale of hourly wages for local transit bus drivers July 1, 1958*

City	Beginning rate	Experienced (top) rate	City	Beginning rate	Experienced (top) rate
Atlanta, Ga	$1.79	$1.89	Milwaukee, Wis	$2.28	$2.32
Baltimore, Md	2.00	2.10	Minneapolis-St. Paul, Minn	2.27	2.34
Birmingham, Ala	1.82	1.87	Newark, N.J	2.06	2.25
Boston, Mass	2.13	2.43	New Haven, Conn	2.09	2.16
Buffalo, N.Y.[1]	2.01–2.15	2.06–2.20	New Orleans, La	2.14	2.20
Charlotte, N.C	1.47	1.57	New York, N.Y.[1]	1.73–2.10	2.11–2.34
Chicago, Ill	2.41	2.46	Oklahoma City, Okla	1.50	1.63
Cincinnati, Ohio	2.12	2.17	Omaha, Nebr	2.07	2.14
Cleveland, Ohio	2.19	2.26	Peoria, Ill	1.91	1.95
Columbus, Ohio	2.11	2.16	Philadelphia, Pa	1.98	2.13
Dallas, Tex	1.82	1.90	Pittsburgh, Pa.[1]	1.76–2.14	1.86–2.28
Dayton, Ohio	1.99	2.09	Portland, Oreg	2.11	2.19
Denver, Colo	1.94	1.98	Providence, R.I	1.96	2.01
Des Moines, Iowa	1.92	2.00	Richmond, Va	1.70	1.80
Detroit, Mich	2.15	2.25	Rochester, N.Y	2.08	2.16
Erie, Pa	1.93	2.03	St. Louis, Mo	2.05	2.20
Grand Rapids, Mich	1.80	1.90	Salt Lake City, Utah	1.69	1.77
Houston, Tex	1.91	2.00	San Antonio, Tex	1.58	1.80
Indianapolis, Ind	2.07	2.14	San Francisco-Oakland, Calif.[1]	2.13–2.45	2.18–2.45
Jacksonville, Fla	1.57	1.69	Scranton, Pa	1.80	1.80
Kansas City, Mo	2.01	2.06	Seattle, Wash	2.25	2.31
Knoxville, Tenn	1.55	1.65	Spokane, Wash	1.84	1.94
Little Rock, Ark	1.57	1.72	Springfield, Mass	1.95	2.05
Los Angeles, Calif.[1]	2.12–2.16	2.16–2.25	Syracuse, N.Y	2.00	2.10
Louisville, Ky	1.85	2.00	Toledo, Ohio	2.10	2.15
Memphis, Tenn	1.87	1.97	Washington, D.C	2.20	2.28

[1] In cities with more than one contract in effect, a range of scales is listed.

SOURCE: Union Wages and Hours: Local Transit Operating Employees, July 1, 1958 (BLS Bull. 1244), table 9.

in New York City and several other large cities belong to the Transport Workers Union of America. The International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) has also organized some local transit bus drivers.

Where To Go for More Information

For information on employment opportunities as a local bus driver, a young man should apply to the local transit company in his area or to the local office of the State employment service.

Taxi Drivers

(D.O.T. 7–36.040)

Nature of Work

In many communities taxicabs are now a necessary part of the regular transportation system. Taxicab drivers, in addition to providing transportation, also perform other services. For example, they assist passengers with their luggage and may also pick up and deliver packages. Cab drivers occasionally provide sightseeing tours for out-of-town visitors.

Drivers get their "fares" or passengers in different ways. Some companies have two-way radio systems over which requests for taxicabs are transmitted to the driver. Other companies have cab stands at which drivers may wait for phone calls from their central office which will direct them to pick up passengers. Many drivers wait in front of theaters, hotels, railroad stations, and other buildings from which large numbers of prospective passengers may emerge. In small cities and in suburban areas, drivers may work from a central location, such as a terminal, to which they return after each trip. Passengers may also be picked up while the driver is returning to his stand or station.

Drivers are usually required to keep records, such as the date, time, and place passengers were picked up, and the destination, time of arrival, and amount of fare collected. If the cab driver owns his own cab or if he rents a cab over an extended period of time he may periodically clean the cab. In large cab companies, this job is generally performed by cleaners employed by the company.

Where Employed

Approximately 135,000 to 150,000 taxi drivers were employed full time in 1958 in the taxicab industry, which is made up of both privately owned cabs and fleets of company owned vehicles. There were also many part-time drivers. Although taxicab drivers are employed in every metropolitan area in the country, the greatest concentration of these workers is found in large cities. New York City, Washington, D.C., Chicago, Philadelphia, Boston, New Orleans, Detroit, St. Louis, and Baltimore lead in the employment of cab drivers.

Qualifications, Training, and Advancement

In order to become a taxi driver in most large cities it is necessary to have, in addition to a State-issued chauffeur's license, a special taxicab operator's license issued by the local police or safety department or Public Utilities Commission. Although licensing requirements vary considerably among cities, in general, applicants must be over 21, in good health, have a good driving record, and have no criminal record.

Cab driver picking up fare.

Most large communities require an applicant for a taxi driver's license to pass a written examination on taxicab and traffic regulations. The examination may include questions on street locations, insurance regulations, accident reports, lost articles, zoning or meter rules, and passenger pickup and deliveries. In some cities, the cab company will teach the driver-applicant taxicab regulations and the location of streets and important buildings. In other cities, the driver may prepare himself for the license examination. After the driver has passed the examination he pays an annual license fee generally ranging from $1 to $5.

Although formal education is seldom required, many companies prefer applicants for a taxi driving job to have at least an eighth grade education. A neat, well-groomed appearance is desirable, as is the ability to deal tactfully and courteously with all types of people. Good foot, hand, and eye coordination are particularly desirable because taxi drivers must often operate their cabs in fast moving and heavy traffic.

Opportunities for advancement for taxi drivers are extremely limited, with promotion to the job of dispatcher often the only possible advancement. Some drivers, however, have become road supervisors, garage superintendents, or claims agents. Many drivers who work for companies try to purchase their own cabs so that they can become their own employers. However, in some large cities the number of cabs is restricted by ordinance, which may limit the opportunity to own cabs in such areas.

Employment Outlook

There will be a large number of opportunities for new workers to become taxi drivers during the 1960–70 decade primarily because of the high turnover rate in this occupation. The level of employment of full-time taxi drivers is not expected to increase to any great extent during the 1960's.

In the past, the employment of taxi drivers has been adversely affected by the increased use of privately owned automobiles, rented cars, and the continuing population shift to the suburbs. In more recent years, however, the level of employment appears to have stabilized. During the next decade, the utilization of taxicabs for local transportation is expected to increase somewhat. Increased population, higher consumer incomes, parking difficulties, and higher local transit bus and street car fares are among the factors which may contribute to a greater use of taxicabs and a slight increase in the employment of taxicab drivers.

This occupation has a relatively high turnover rate which results from the lack of assurance of a steady income, long hours, and the use by some workers of this job as stopgap employment when better jobs are not available. Transfers from this occupation are expected to be the major reason why employment opportunities will be available for many new workers who wish to enter this field of work.

Earnings and Working Conditions

Although earnings data on a national scale are not available, wage information collected from a small number of employers in large cities on the East Coast and in the Midwest indicates that, in 1958, full-time taxi drivers earned, with their tips, from $60 to about $100 a week for a 6-day week. Most full-time drivers in these areas averaged about $75 or $80 a week. Driver-owners earned about the same amount, after deduction of their overhead and driving costs.

Most taxi drivers employed by taxicab companies are paid a percentage—usually between 40 and 50 percent—of the total fare. Drivers also frequently receive tips, ranging from 10 to 20 percent of the fare. Some companies pay their drivers a salary and give them an additional commission based upon the amount of business the drivers do. A few companies guarantee their drivers minimum daily or weekly earnings. Some drivers rent their cabs by the day for a set price and any receipts above the cab rental and other operating expenses are retained by the drivers.

A large percentage of full-time taxi drivers work 9 or 10 hours a day for 6 days a week. They usually begin work between 6 a.m. and 8 a.m. Many drivers work nights, starting from 3 p.m. to 5 p.m. Some drivers work on Sundays and holidays.

Taxi drivers usually put in long hours of work and do not receive overtime pay. Many of them do not receive fringe benefits, such as pensions and severance pay, that workers in many other occupations receive. When economic conditions decline, their earnings are generally reduced because of increased competition for less business.

Many college students have been able to work their way through school by driving cabs on a part-time basis and during summer and spring holidays. Some workers also become part-time drivers in order to supplement their regular income.

Driving a taxicab is not physically strenuous. Most drivers do not change tires or do other heavy repair work. Drivers are, however, subject to nervous tension from driving in heavy traffic and dealing with passengers who differ markedly in their personalities.

Many drivers find the lack of direct supervision by an employer one of the more desirable aspects of their job. They may, however, be subject to municipal regulations which govern their personal appearance, the fares they charge, and their driving habits.

Although unionization in this occupation is not widespread in small cities, taxi drivers in many of the large cities belong to labor unions, particularly those who work for the large taxicab companies. The main union in this field is the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

OTHER TRADES AND INDUSTRIAL OCCUPATIONS

Blacksmiths

(D.O.T. 4–86.010)

Nature of Work

The blacksmith makes and repairs metal articles, such as tools and other industrial and agricultural equipment, by heating the metal in a forge and hammering it into shape on an anvil. He also forge-welds metal by heating separate pieces and hammering them together. He sharpens chisels, drills, picks, and other tools by reshaping the cutting edges.

By observing its color, the blacksmith determines when the metal being heated in the forge is ready for hammering. He then removes the metal and hammers it into shape by hand or machine. After the article is formed, the blacksmith may heat-treat the metal to bring it to the proper hardness and temper. To harden tools, the blacksmith heats them to a high temperature in a heat-treating furnace and quickly cools them in an oil or water bath. In tempering, (the process of making metal tougher and less brittle), the metal is heated in a tempering furnace to a temperature less than that used for hardening. The metal is kept at the tempering temperature for a specified time, and then allowed to cool gradually in the air.

Blacksmiths use hand hammers, tongs, and chisels in their work. In addition to these handtools, they often use welding equipment, grinders, presses, and automatic hammers.

Where Employed

In 1958, about 40 percent of the Nation's 40,000 blackmiths worked in small shops repairing farm and garden equipment, tools, automobile parts, and household articles. Often, these shops perform other services such as welding and tool dressing; a few shoe horses. Most of these blacksmiths are self-employed.

The other workers in this occupation are the industrial blacksmiths, employed for the most part in the maintenance and repair departments in many industries. The leading industry in the employment of blacksmiths is the petroleum industry, where most of these workers sharpen and temper drilling bits and tools and assist the driller in operating and maintaining the drilling equipment. Other important employers of blacksmiths are the railroad, construction, coal- and metal-mining, steel, and machinery-manufacturing industries. Some blacksmiths work at production jobs in metalworking establishments where they operate automatic machines to make large numbers of identical articles.

Blacksmiths work in all parts of the country, in small rural communities as well as in large industrial centers. There is some concentration of employment in Pennsylvania, Texas, and Illinois.

Training and Other Qualifications

Most workers enter the occupation by picking up the trade while working as helpers in blacksmith shops. Others enter through apprenticeship training. The apprenticeship period is generally 3 or 4 years and customarily includes training in blueprint reading, the use of tools and equipment, heat-treatment of metal, forging methods, and welding. Blacksmiths in the railroad industry usually begin as apprentices. High school and vocational school courses in metalworking, blueprint reading, and mathematics will prove helpful to young persons interested in becoming blacksmiths.

A blacksmith must have considerable strength in order to pound metal into shape and to handle heavy parts. He must also have a precise touch in the shaping of metal parts even though he uses heavy tools and equipment.

Employment Outlook

There will be a small number of opportunities each year for new workers to enter the field during the 1960's. Openings for new workers will

Blacksmith shaping metal piece with hammer.

occur primarily because of replacement needs. A high proportion of the experienced blacksmiths are older men who will be leaving the labor force. Retirements and deaths will result in about 1,500 openings a year for new workers during the 1960 decade.

Prospects for the small number entering the occupation are for continued employment over a long period. About 40,000 blacksmiths were employed in late 1958, substantially fewer than 20 or 30 years earlier. However, in recent years, the decline in employment has been slight and no substantial change in the demand for blacksmiths is anticipated in the next decade. The number of blacksmiths working in small repair shops is expected to remain stable because of the diversified demands for their services in both rural and urban areas. Since blacksmiths employed in manufacturing plants, railroads, construction, and mines generally do maintenance work, which tends to be fairly steady, there should not be much fluctuation in the employment of these blacksmiths.

Earnings and Working Conditions

The earnings of skilled blacksmiths depend upon the part of the country where they are employed and the kind of shop or industry in which they work. In July, 1958, the average straight-time hourly earnings for blacksmiths employed in railroad shops was $2.47. The union base rate for experienced blacksmiths in the steel industry was $2.83 an hour. With incentive pay and cost-of-living adjustment, they earned about $3.50 an hour in the steel industry. Although no overall wage data are available for blacksmiths employed in the petroleum industry, an examination of a few 1958 union contracts indicates that blacksmiths (tooldressers), working as part of drilling teams in the oilfields, earned more than $2.50 an hour. Wage data collected from a limited number of employers indicated that blacksmiths generally were receiving between $2.20 and $2.75 an hour in early 1958.

Although all blacksmith shops are rather hot and noisy because of the furnaces and hammers, there is some variation in the conditions under which blacksmiths work. In small repair shops, the noise is not constant and the temperature is more easily controlled. The large forges and the sound of many automatic hammers in large production shops create considerable heat and noise. In recent years, however, the introduction of large ventilating fans and the reduction of machine vibration have improved working conditions in production shops.

Blacksmiths are subject to a number of hazards. These include burns from forges and heated metals, and injuries from large pieces of metal which may drop while being handled. Safety devices such as goggles, metal-tip shoes, and leather aprons have reduced hazards in this trade.

Many blacksmiths belong to unions. The principal union of the trade is the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Other blacksmiths are members of industrial unions such as the Oil, Chemical and Atomic Workers International Union and the United Steelworkers of America. Many union agreements provide health insurance and pension plans for blacksmiths.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City 11, Kans.

Boilermaking Occupations

Nature of Work

Boilermakers, layout men, and fitup men specialize in the repairing, fabricating, and assembling of boilers, tanks, vats, and similar vessels made of metal plate. These boilers and other vessels are widely used throughout industry to hold liquids and gases under pressure. Boilermakers are primarily engaged in the repairing and erecting of boilers, while layout men and fitup men are usually employed in the manufacturing of new boilers and heavy tanks. The repair work performed by boilermakers requires these workers to be all-round skilled craftsmen; fitup men and layout men have more specialized duties.

Boilermakers (D.O.T. 4–83.100). These craftsmen assemble and erect prefabricated parts and fittings at construction sites where the boilers or vessels are to be used. After the installation is completed they make all the necessary tests to check for defects. Boilermakers doing repair work in the field first determine the cause of trouble. They may then dismantle the boilers, vessels, or other units, and make repairs such as patching weak spots with metal stock, replacing defective sections with new parts, or strengthening joints. The repair and installation work performed by boilermakers must often meet standards set by local building codes.

Boilermakers use a variety of tools and equipment in repair and assembly work. They cut and shape plate to size with power shears, power rolls, power presses, or oxyacetylene torches. They use welding or riveting equipment when repairing or assembling boilers. When assembling and erecting steel plate units in the field on a construction site, the boilermakers may use all types of rigging equipment including hoists, jacks, and rollers.

Layout Men (D.O.T. 4–83.200). In the manufacture of units made of heavy steel plate or other metals, the metal is initially prepared for fabricating operations by layout men. They mark on the plates and tubes all curves, lines, points, and dimensions which serve as directions to other workers for the cutting or shaping of the parts of boilers, tanks, and pressure vessels. They lay out the parts to scale as outlined on blueprints, sketches, or patterns. Layout men use compasses, dividers, scales, surface gages, hammers, and scribers in laying out the parts to be fabricated.

Fitup Men (D.O.T. 4–83.300). Before the various parts of boilers, tanks, vats, or other vessels are finally assembled, the fitup men assemble and temporarily fit them together in the shop. They bolt or tack weld parts together and correct irregularities in parts so that they fit together neatly and securely. Fitup men also assemble and fit together nozzles, pipes, fittings, and other parts.

Fitup men read and interpret blueprints and drawings used in the manufacturing process in order to check parts for accuracy and fit according to specifications. They use handtools such as hammers, sledges, wrenches, and punches, and equipment such as welding machines, portable drills, and grinding tools.

Where Employed

Boilermakers are employed principally in repair shops which specialize in servicing and repairing boilers and pressure vessels used in commercial and industrial companies; they also are

Boilermakers assembling units made of heavy steel plate.

employed in the railroad transportation and construction industries. The boilermakers employed by the railroads work, for the most part, in locomotive shops where they maintain and repair locomotive and stationary boilers, fireboxes, tanks, and other parts made of sheet iron or plate steel. Many boilermakers also work in the maintenance departments of industrial establishments to maintain and repair boilers, tanks, and other vessels. More than 1,900 boilermakers were employed in early 1957, in Federal Government installations, principally in Navy shipyards and Federal powerplants.

Boilermakers are employed in every State because of the widespread need for their skills in maintenance and repair work. However, most of the boilermaking jobs are located where the metalworking industries and railroad shops are concentrated. Pennsylvania, Ohio, Illinois, and New York have the largest numbers of boilermaking jobs. In the West, California and Texas lead in the employment of boilermakers.

Layout men and fitup men are primarily employed in the boilershop products industry which produces fire-tube boilers, heat exchangers, heavy tanks, heating boilers, water-tube boilers, and similar boiler-type items. Most layout men and fitup men are employed in the industrial Middle Atlantic and East North Central areas where the boilershop products industry is concentrated.

Training and Other Qualifications

Although many men have become boilermakers by working as helpers for several years, most training authorities agree that a 4-year apprenticeship is the best way to learn this trade. In the apprenticeship program, the apprentice works under the close supervision of a journeyman who instructs him in the skills of the trade. The apprentice learns how to use the tools and machines of the trade during his training period. Apprenticeship programs usually provide for about 8,000 hours of relatively continuous employment and training supplemented by at least 576 hours of related technical instruction. Some of the related technical subjects studied by apprentice boilermakers during their training period are: blueprint reading, trade mathematics, welding techniques, and trade metallurgical science covering stress and strain of metals.

Many layout men and fitup men learn their skills on the job. They are usually first hired as helpers and pick up the trade by working with experienced workers. It generally takes at least 2 years to qualify as a journeyman layout or fitup man in a fabricating shop where boilers and vessels are produced on a mass-production basis. However, in the railroad industry and in shops where products are custom made, layout and fitup jobs are generally filled by men who have first qualified as skilled boilermakers.

Prior training in mathematics, blueprint reading, and shopwork will prove helpful to young men interested in entering these trades. Mechanical aptitude and manual dexterity are important qualifications for persons who want to become boilermakers, layout men, or fitup men. They are also required to be in good physical health and able to do heavy work.

Employment Outlook

During the 1960's, a moderate rise in the employment of boilermakers, layout men, and fitup men can be expected. Most opportunities for new workers, however, will result from replacement needs.

The expected large expansion in electric power generation facilities and the development of atomic energy for industrial use will result in an increased need for these workers in boiler manufacturing plants and in the construction industry for the fabrication and assembly of industrial power boilers, smokestacks, heavy tanks, and other large vessels. Some additional maintenance boilermaking jobs will be created by the expansion of facilities in petroleum refineries, chemical plants, electric light and power plants, and steel plants.

In contrast to this growth, the employment of boilermakers in railroad repair shops is expected to decline. The number of these workers has been declining steadily since World War II because diesel engines have been replacing steam locomotives. In 1950, the railroads employed 9,800 boilermakers, but by 1957, the employment of boilermakers in this industry had dropped to about 3,600.

Replacement needs will be the primary factor in creating job opportunities for new workers in these trades. Because a high proportion of experienced boilermakers, fitup men, and layout men are older men, many will be leaving the labor force during the next 10 to 20 years. Retirements and deaths may create about 8,000 new jobs during the 1960's. Additional job openings will be created by the transfer of experienced workers in these occupations to other fields of work.

Earnings and Working Conditions

The earnings of skilled boilermakers compare favorably with those of other skilled craftsmen. For example, the union wage rate of maintenance boilermakers in the basic steel industry was $2.99 an hour in July 1958. The average straight-time hourly earnings of boilermakers employed by Class I railroads were $2.46 an hour in February 1958. Recent earnings data of fitup men and layout men are not available.

According to a Bureau of Labor Statistics study of union wage scales in the building trades in cities of 100,000 or more population, the average minimum hourly scale for union journeymen boilermakers was $3.72 in July 1958. The minimum union wage scale for these workers in this study ranged from $3.45 an hour in Atlanta, Ga. and Charlotte, N.C., to $4.61 an hour in Newark, N.J. Boilermakers employed in the building trades are not as steadily employed throughout the year as those who work in maintenance departments of large industrial establishments.

Many boilermakers, layout men, and fitup men are employed in metalworking plants which have labor-management contracts. Some of these agreements provide health, insurance, and pension plans.

When engaged in boiler repair and assembly work, boilermakers are often required to work in cramped quarters and in high places. Some work must also be done under conditions of dampness, heat, and poor ventilation.

Boilermaking tends to be more hazardous than many other metalworking occupations. Although the injury-frequency rate in the boilershop products industry is considerably higher than the average for manufacturing industries as a whole, it has been declining in recent years because of the safety programs of employers and unions.

Most boilermakers, layout men, and fitup men belong to unions. The principal union of these trades is the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Some of these craftsmen are also members of industrial unions, such as the Industrial Union of Marine and Shipbuilding Workers of America, the Oil, Chemical and Atomic Workers International Union, and the United Steelworkers of America.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City 11, Kans.

Dispensing Opticians and Optical Laboratory Mechanics

Nature of Work

The millions of persons who depend on eyeglasses readily appreciate the importance of the work of dispensing opticians and optical laboratory mechanics. These workers, often called optical technicians, perform the skilled operations required to make prescription eyeglasses. (The prescription, written by a physician or optometrist, specifies the type of lenses needed to correct a patient's visual defect.) In general, dispensing opticians deal directly with patients and the laboratory mechanics do the shopwork. In some cases, however, both jobs are performed by the same person.

The *dispensing optician* (D.O.T. 5-08.010) works in a retail optical establishment where he directly serves patients being fitted for eyeglasses. His principal responsibility is to ensure that patients obtain eyeglasses that follow the lens prescriptions and fit properly. He determines the appropriate frame and lens sizes by measuring and trying on different size frames and computing the exact location of the lenses in relation to the eyes. On lenses such as bifocals, he determines the proper height and position of the different lens parts. He also assists patients in selecting the style and color of frames.

The dispensing optician prepares a work order for the workers in the shop (laboratory) so the lenses may be properly ground and mounted. The work order consists of the lens prescription and information on the size of the lens as well as the size, color, style, and shape of the frame. After the finished eyeglasses are returned from the laboratory, the optician may adjust the frame to fit properly. The dispensing optician uses small handtools, such as optical pliers, hammers, pupilary distance rulers, and screwdrivers.

The *optical mechanic* (D.O.T. 5–08.010) performs the shop or laboratory work required to make the eyeglasses. There are two principal types of mechanics, the *surfacer* (D.O.T. 5–08.077) and the *benchman* (or finisher) (D.O.T. 5–08.033). The surfacer, starting with standard or stock size lens blanks, lays out the work, grinds and polishes the surfaces of the lenses, and makes a final inspection to make sure the lenses meet prescription requirements. In small shops, one mechanic may perform all these operations. In large shops, the work is divided into separate operations so that semiskilled workers may perform part of the job. The surfacer operates large power grinding and polishing machines in shaping the lens surfaces. He also uses special equipment such as a lensmeter to measure the curvature of a lens by light, or a device which mechanically measures the curvature and power of a lens.

Optical machanic (finisher) hand beveling a nearly completed lens.

The other principal type of optical mechanic—the benchman or finisher—marks and cuts the ground lenses to fit the frame. He then bevels or smooths the edges of the lenses and assembles the lenses and frame parts into the finished eyeglasses. In large laboratories, these operations are divided into job specialties which are performed by semiskilled workers. The benchman uses small tools in his work, such as lens cutters, chippers, pliers, and diamond point glass drills.

Both the surface man and the benchman also do repair work. They may also match broken lenses and replace damaged parts of the frame.

Where Employed

About 16,000 dispensing opticians and optical mechanics were employed throughout the country in mid-1958. Of these, about 7,500 (2,500 dispensing opticians and 5,000 optical mechanics, mostly benchmen) were employed in the Nation's 3,000 retail optical shops, which directly serve individuals by making their eyeglasses from prescriptions written by physicians or optometrists. The remaining 8,500 workers (mostly surface men) were employed in the prescription departments of the more than 1,100 wholesale and manufacturing establishments which did work for retail optical firms. In addition to the 16,000 technicians mentioned above, many of the approximately 2,500 proprietors of retail optical establishments were skilled optical mechanics or dispensing opticians. Dispensing opticians and optical mechanics are primarily employed in cities and industrial areas. New York, Pennsylvania, Ohio, California, and Illinois are the leading States in the employment of these workers.

Training, Other Qualifications, and Advancement

Most dispensing opticians and optical mechanics pick up their skills through informal, on-the-job training. Mechanics start in entry jobs in laboratories as grinders, polishers, or in unskilled finishing jobs, such as that of bevelers. After a few years of experience under trained mechanics, they learn how to perform the skilled work in their shops. Some then move into dispensing offices and, with some additional training, become dispensing opticians. A small number of opticians start immediately in dispensing work and learn their jobs under the guidance of trained opticians.

In addition to this informal method, young persons who are high school graduates can prepare for these occupations through formal apprenticeship programs. Most training authorities agree that workers who have learned their trade as apprentices have more job opportunities, improved job security, and are able to advance further in their careers. The length of the apprenticeship programs depends on the trainees' ability and desire to learn. A number of optical firms have 4- and 5-year apprenticeship programs.

The typical program for an apprentice optical mechanic includes on-the-job training and related instruction in opthalmic optics (vision improvement). This training qualifies a person for both surfacing and finishing work. However, apprentices may specialize in one phase of this work in the larger laboratories. The apprenticeship program for the surfacer emphasizes training in grinding operations, polishing, blocking, inspection, and layout. The benchman apprenticeship program concentrates on lens edging, cutting layout and lens cutting, lens drilling and rimless spectacle assembly, frame inserting, and inspection. In addition to this work experience, the apprentice optical mechanic receives related instruction. This includes the identification of types of lenses, the measurement and curvature of lens surfaces, lens power, light prism power, prescription writing, and frame and eyeglass mounting.

The dispensing optician apprentice is given training similar to that of the bench apprentice. He receives additional instruction in optical mathematics, the relationship of the lens to the eye, the mechanics of dispensing, and the inspection of eyeglasses.

Formal school training plays a relatively small part in preparing for these occupations. However, academic training for entry into the dispensing optician occupation is being encouraged. In 1958, at least two schools were offering a 2-year course at the college level in dispensing opticianry and a few vocational schools had courses for the training of optical mechanics.

Some States require dispensing opticians and optical mechanics to be licensed. Two States—Connecticut and New Jersey—license optical mechanics. Thirteen States—Arizona, Connecticut, Georgia, Florida, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Tennessee, Virginia, and Washington—require dispensing opticians to be licensed.

Advancement possibilities are available to both optical mechanics and dispensing opticians. Laboratory technicians can become supervisors or foremen. Many laboratory workers have become dispensing opticians, although there has been a trend in recent years to train especially for this latter job. There are opportunities for mechanics and dispensing opticians to go into business for themselves. In the last 10 years, the number of proprietors of optical establishments has doubled —reaching a total of about 3,000 in 1958. These owners came, for the most part, from the ranks of mechanics and dispensing opticians.

Employment Outlook

A relatively large increase in these two occupations is expected in the 1960's. This will be a continuation of the trend of the last 15 years during which time the number of optical technicians grew at a somewhat faster rate than the Nation's total labor force. Replacement needs will also provide a few hundred job opportunities each year for new workers.

More optical mechanics and dispensing opticians will be needed to perform the expected growing amount of prescription lens work. Our country's expanding population and the growing number of older persons—the group most likely to need eyeglasses—are among the factors which will cause an increase in the output of prescription lenses above the 1958 level of approximately 24 million pairs. More glasses will also be needed because good vision is becoming more essential to the type of work being performed in industry and in offices. Furthermore, eyeglass frames are now subject to style changes resulting in more frequent changes in prescription lenses. The increasing demand for eyeglasses should result in a continued growth in the number of optical technicians, since no significant technological changes in this field are anticipated during the 1960–70 decade.

Although few women are employed as dispensing opticians or optical mechanics, they are being encouraged to enter the field.

Some of the more specialized jobs found in the larger laboratories can be performed by physically handicapped persons who have full use of their eyes and hands and can do sedentary work.

Earnings and Working Conditions

Weekly earnings for qualified mechanics generally ranged from about $75 to $125 a week in mid-1958. Dispensing opticians usually earn about 20 percent more than optical mechanics. Apprentices start at about 50 percent of the skilled worker's rate. In the course of their training, their wages are increased periodically, so that at the end of the apprenticeship period they are receiving the pay of skilled technicians. Wholesale establishments usually have a 5-day, 40-hour workweek. Retail shop employees generally work a 5½- or 6-day week. Workers in these occupations usualy have year-round employment.

The work of the dispensing optician requires little exertion and is generally performed in pleasant surroundings. Some laboratories may be fairly noisy because power grinding and polishing machines are used in preparing prescription lenses. Also, the mechanic may soil his hands from the emery and rouge used in grinding and polishing.

Where To Go for More Information

Association of Independent Optical Wholesalers,
222 West Adams St., Chicago 6, Ill.

Guild of Prescription Opticians of America,
110 East 23d St., New York 10, N.Y.

Optical Wholesalers National Association,
30 East Broad St., Columbus 15, Ohio.

Electroplaters

(D.O.T. 4–74.010)

Nature of Work

Electroplaters, by use of plating solutions and electric current, coat metal articles with a layer of chromium, nickel, silver, gold, or other metal to provide a protective surface or a more attractive appearance. Such widely different items as automobile bumpers, cigarette lighters, silverware, costume jewelry, plumbing fixtures, electrical appliances, bearings, component parts of electronic equipment, jet engine parts, and ammunition are examples of metal products which are often electroplated.

The skilled plater first studies specifications which indicate the parts of the objects to be plated, the type of plating metal to be applied, and the desired thickness of the plating. He prepares the plating solution by mixing the proper chemicals. The plater also calculates the amount of electric current required to carry the metal particles through the plating solution and the length of time the objects must remain in the solution so that the plating metal will be of the specified thickness. A plater must often use originality in designing special racks for holding the objects while they are in the plating tank.

In preparing an article for electroplating, the plater cleans it by dipping it in cleansing solutions, by scouring, or by buffing. He covers, with lacquer, or with rubber or plastic tape, any part of the article which is not to be plated. He then places the article in the plating tank, where an electric current carries particles of metal through the solution from the anode (the metal to be deposited) to the surface being plated. When the desired thickness has been obtained, he removes, rinses, and dries the article.

The plater must analyze the plating solution periodically and sometimes add chemicals to keep the solution constant. It is also necessary for him to control the temperature of the solution. He examines finished articles for defective plating and may use micrometers and calipers to check the thickness of the plating. In addition to plating, platers do other kinds of finishing, such as spray painting, dipping, and flow painting.

Electroplaters employed in job shops, which do small lot plating of great variety, are often required to use considerable ingenuity in their work. Platers working in production shops, where large lots of metal parts of the same type are electroplated, usually carry out routine assign-

COURTESY OF NATIONAL ARCHIVES

Electroplater removing racked articles from plating bath.

ments. In some of the larger shops, chemists and chemical engineers often make the technical plating decisions while platers act as foremen and do some of the routine plating work.

As a foreman, a plater often supervises the work of helpers, who place objects on racks before plating, remove them after plating, and clean tanks and racks. In some shops, a plater is expected to order chemicals and other supplies for his work.

Where Employed

Although electroplating shops are found in almost every part of the country, most are concentrated in the Northeast and Midwest near the centers of the metalworking industry. More than 25 percent of the approximately 20,000 platers employed in late 1958 were working in Chicago, Detroit, New York, Cleveland, Newark–Jersey City, Providence, and Buffalo.

About 8,000 electroplaters were employed in job shops specializing in metal plating and polishing in early 1959. The remaining platers were employed in the plating departments of plants primarily engaged in the manufacture of plumbing fixtures, heating and cooking utensils, lighting fixtures, wire products, electric control apparatus, electric appliances, radio and television products, motor vehicles and parts, mechanical measuring instruments, miscellaneous hardware items, and other metal products.

Training, Other Qualifications, and Advancement

Most platers are first hired as helpers and then learn the trade by working with skilled platers. It usually takes 4 years or longer to become a skilled worker in this way. Since less time is required to learn to work with only one or two metals, many employers tend to develop specialized platers rather than those who can work with all kinds of metals. This often makes it difficult for a plater to transfer to shops doing other kinds of electroplating.

Another way to enter the electroplating trade is through an apprenticeship program. Although apprentice training provides better all-round preparation, only a small percentage of electroplaters have been trained this way.

The planned program for apprentices includes a combination of on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity, as applied to plating. The apprentice does progressively more difficult work as his skill and knowledge increase. By the third or fourth year, he determines cleaning methods, does plating without supervision, makes solutions, examines plating results, and supervises helpers. After 3 or 4 years of an apprenticeship program or general work experience, the worker usually becomes a fully qualified plater. From this position he may qualify as a foreman.

High school and vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading will prove helpful to young persons interested in becoming master electroplaters. Some colleges, technical institutes, and vocational high schools offer 1- to 2-year courses in the principles and practices of electroplating. In addition to the training offered by these schools, many branches of the American Electroplaters' Society conduct basic courses in the fundamentals of electroplating. Young men in the Armed Forces can gain experience in this work which would be helpful in obtaining civilian employment. The increasing complexity of the plating process and the greater use of precision plating will require platers with a higher degree of technical training in the future.

Employment Outlook

The expected expansion in the machinery and metalworking industries and the broader application of the plating process brought about by recent developments in the use of aluminum, other metals, and metal alloys will increase the demand for skilled electroplaters in the 1960's. In addition to the new job openings which are expected to develop because of the increased use of the electroplating process, a small number of vacancies will develop from the need to replace those workers who retire, die, or shift to other lines of work.

A factor which is limiting the growth of this occupation to some extent is the tendency of some of the large highly mechanized plants to employ chemists and chemical engineers to plan the plating operations, and to use skilled platers only as foremen.

The growing use of anodizing—another method of finishing metals, used almost exclusively on aluminum products—may have some adverse effect on the use of the electroplating process in the future. However, with only little additional training, electroplaters can do this work since the equipment and skills required are similar.

Earnings and Working Conditions

Little information is available on the earnings of skilled electroplaters. However, an examination of a number of union contracts and information secured from a limited number of employers indicated that electroplaters were earning from $1.75 to $2.65 an hour in late 1958. During a worker's period of apprenticeship or on-the-job training, his wage rate usually starts at 60 to 70 percent of a skilled worker's rate, and progresses to the full rate by the end of his training period. In almost all plants, workers are paid shift premiums for working at night.

Plating work involves some hazards because acid, alkaline, or poisonous solutions are used. Problems of humidity and odor also prevail in electroplating plants. However, most plants have installed systems of ventilation and other safety devices which have considerably reduced the occupational hazards. Protective clothing and boots provide additional protection. There are generally mechanical devices to handle most of the lifting, but at times the worker must lift and carry objects weighing up to 100 pounds.

Many platers are union members. Most union platers belong to the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America and the International Association of Machinists. Many of the labor-management contracts covering electroplaters provide health, insurance, and pension plans.

Where To Go for More Information

For more information on job opportunities, training, and other questions write to:

American Electroplaters' Society,
445 Broad St., Newark 2, N.J.

National Association of Metal Finishers,
60 Bently Road, Cedar Grove, N.J.

Stationary Engineers

(D.O.T. 5–72.010)

Nature of Work

The man in charge of the heating equipment in a large school is likely to be a stationary engineer. These workers are members of one of the larger skilled occupations in the United States and are needed wherever large boilers, diesel and steam engines, refrigeration and air-conditioning machinery, electric generators, motors, and turbines are used.

The stationary engineer operates and maintains all the different kinds of equipment used to generate power and to heat, ventilate, and air-condition large buildings and other structures. The equipment for which the stationary engineer is responsible is used in many types of large establishments, such as factories, power stations, mines, sewage plants, office buildings, hotels, and hospitals. He has a responsible job, for he must know how to operate the equipment in accordance with safety regulations and how to keep it in good working order.

The duties of stationary engineers depend, to a considerable extent, on the size of the establishment in which they work and the type and size of machinery for which they are responsible. For example, in relatively small plants, the engineer himself may oil and clean the equipment, clean boiler tubes and walls, and grease moving parts. In large plants, he may supervise other stationary engineers or such workers as turbine operators, firemen, and oilers in the operation and maintenance of equipment. Stationary engineers employed in small plants are usually responsible for all types of stationary machinery and equipment; in some very large plants, they may be in charge of only one type of machinery or operation.

To make sure that everything is working properly, the stationary engineer inspects the equipment regularly each day. He reads meters, gages,

Stationary engineer adjusting a valve.

and other instruments, and records such information as amount of fuel used, temperature of boilers, number of pieces of equipment in use, hours of operation, and repairs made. He must be able to detect and identify trouble that develops by analyzing the various readings and watching and listening to the machinery. He uses levers, throttles, switches, valves, and other devices to regulate and control the machinery so as to achieve maximum efficiency.

Stationary engineers also may repair the equipment they operate, using handtools such as wrenches and hammers. The replacing of worn valves and gaskets are common repair jobs performed by these workers. Some stationary engineers may sometimes make mechanical changes in their equipment or construct special attachments so that the machinery will operate more efficiently.

Where Employed

Slightly more than 200,000 stationary engineers were employed in a wide variety of establishments in 1958. More than 30,000 of these workers were employed by Federal, State, and local governments. The types of establishments in which the engineers worked ranged in size from giant hydroelectric plants and large public buildings to small industrial plants. While staffs of stationary engineers may range anywhere from 1 to more than 60 on all shifts, most plants employ from 3 to 8 engineers. In some establishments, only one engineer is at work in each shift.

Because stationary engineers work in so many different kinds of establishments and industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial establishments are located. New York, Pennsylvania, Illinois, Texas, California, and Ohio are leading States in the employment of these workers.

Training, Other Qualifications, and Advancement

Although the majority of licensed stationary engineers started as helpers and acquired their skills largely through informal on-the-job experience, many training authorities recommend formal apprenticeship as the most desirable method for learning this occupation. The increasing complexity of stationary machinery and the varied training and experience required for the first-class stationary engineer license makes formal training more necessary today. After completing apprenticeship, a journeyman stationary engineer usually must get further work experience before he can qualify for a first-class license. This license is the accepted proof of a worker's qualifications and the ultimate goal of his training.

In selecting apprentices, most employers generally prefer young men between 18 and 23 years of age with high school or trade school education, who have received training in such subjects as algebra, geometry, trigonometry, shop mathematics, mechanical drawing, machine-shop practice, physics, and chemistry. Employers also desire young men with mechanical aptitude and manual dexterity.

A stationary engineering apprenticeship customarily takes 4 years. Through on-the-job training, the apprentice learns to operate, maintain and make repairs on the equipment, such as blowers, generators, compressors, boilers, motors, and air-conditioning and refrigeration machinery. He is taught how to use a variety of hand and machine tools, such as chisels, hammers, small electric grinders, lathes, and drill presses. He also may use measuring instruments such as calipers and micrometers. In addition, he may be taught how to use blocks, chain hoists, and other equipment used to move machinery. He must supplement this on-the-job training by instruction in such related technical subjects as practical chemistry, elementary physics, blueprint reading, applied electricity, and theory of refrigeration, air conditioning, ventilation, and heating.

Persons who become stationary engineers without going through a formal apprenticeship program usually do so only after years of experience as assistants to licensed stationary engineers in such occupations as boiler, refrigeration, or turbine operator. This practical experience usually must be supplemented by vocational or other school training or home study.

Almost every large- or medium-size city and a few States require stationary engineers to be licensed. Although license requirements differ from place to place, the following are usual: (1) The applicant must be over 21 years of age; (2) he must have resided in the State or locality in which the examination is given for a specified period of time; and (3) he must demonstrate that he meets the experience requirements for the class of license requested. A license is issued to the applicant upon passing the examination which may be written, oral, or a combination of both types.

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Stationary engineer licenses are designated as first-class, second-class, or third-class. Stationary engineers with second- and third-class licenses are permitted to operate only the smaller equipment independently. However, they may operate large equipment under the supervision of a higher rated engineer—usually one with a first-class license. Generally, under first-class licenses, no restriction is placed on the equipment the engineer may operate.

Stationary engineers may advance in three ways. First, an engineer may receive a higher grade license. Advancement, however, is not automatic since a first-class stationary engineer may work for some time as an assistant to another first-class engineer before a vacancy occurs, permitting him full use of his license. Second, a worker may advance by obtaining a job in a plant where he is responsible for larger or more diverse equipment. Stationary engineers also may advance to jobs as plant engineers and building and plant superintendents. In general, the broader the knowledge a stationary engineer has about the design, operation, maintenance, and repair of various types of equipment, the better are his chances for advancement.

Employment Outlook

A moderate increase in employment of stationary engineers is expected during the 1960's. In addition, about 5,000 opportunities for new workers to enter this large field of employment will occur each year because of the need to replace workers who retire or die. Transfers out of this occupation to other fields of work also will be a source of job openings for new workers.

The continuing increase in the use of large stationary boilers, refrigeration, and air-conditioning equipment in the Nation's factories, powerplants, and commercial buildings is the primary factor indicating an increase in employment in this occupation. However, improved operating efficiency resulting from the use of larger and more centralized equipment and better utilization of manpower may limit somewhat the growth in the employment of stationary engineers.

The increasing use of atomic energy should not affect significantly the employment of stationary engineers. It is probable that both the number and skill requirements of operating jobs (i.e., stationary engineer, boiler operator, turbine operator, etc.) in a nuclear plant will be about the same as those in a new conventional powerplant.

Earnings and Working Conditions

Average hourly earnings of stationary engineers in many large cities in 1958–59 ranged from $1.97 to $2.98 an hour. In addition to differences in rates of pay from city to city, the size and kind of equipment operated, and the type of establishment in which the engineer is employed determine his earnings within a city. Stationary engineers who have supervisory responsibilities may earn considerably more than the average; some of these workers in large establishments earn more than $150 a week.

The following table, based upon wage surveys made by the U.S. Department of Labor's Bureau of Labor Statistics in 1958–59 indicates the average straight-time hourly earnings in 15 large cities and metropolitan areas (the wage rates of the head or chief engineer in establishments employing more than 1 engineer are not included in these wage rates):

	Average straight-time hourly earnings
Baltimore	$2. 38
Boston	2. 51
Buffalo	2. 59
Dallas	2. 07
Denver	2. 54
Detroit	2. 98
Los Angeles-Long Beach	2. 93
Memphis	2. 19
Minneapolis-St. Paul	2. 60
Newark-Jersey City	2. 92
New Orleans	1. 97
Philadelphia	2. 34
St. Louis	2. 74
San Francisco-Oakland	2. 88
Seattle	2. 56

Stationary engineers generally enjoy steady year-round employment. They usually work a straight 8-hour day with a workweek ranging from 40 to 48 hours. In plants or institutions which operate around the clock, stationary engineers may be assigned to any one of three shifts —often on a rotating basis—and to Sunday and holiday work.

Many stationary engineers are employed in plants which have labor-management contracts, most of which provide benefits which may include hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions. Similar benefits may also be provided in plants in which labor-management contracts have not been negotiated. Among the unions to which these workers belong are the International Union of Operating Engineers, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

Although most of the engine rooms, powerplants, or boiler rooms where stationary engineers work are clean and well lighted, this is by no means true in every case. Even under the most favorable conditions, some stationary engineers are exposed to high temperatures, dust, dirt, contact with oil and grease, and odors from oil, gas, coal, or smoke. In repair or maintenance work, they may have to crawl inside a boiler and work in a crouching or kneeling position to clean or repair the interior.

Because stationary engineers often work around boilers and electrical and mechanical equipment, they must be alert to avoid burns, electrical shock, and injury from moving machinery. If the equipment is not operated correctly or if it is defective, it may be dangerous to them, as well as to other persons in the vicinity. However, modern equipment and safety procedures have reduced accidents greatly.

Where To Go for More Information

Further information on this occupation may be secured from State or local licensing agencies. Locals of the International Union of Operating Engineers also may be an important source of information. Additional information may be obtained from:

International Union of Operating Engineers,
1125 17th St. NW., Washington 6, D.C.

International Union, United Automobile, Aircraft & Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 4, Mich.

Welders and Oxygen Cutters

Nature of Work

Many of the parts used in automobiles, airplanes, refrigerators, and thousands of other products are joined by a widely used metalworking process known as welding. Welding is an efficient, dependable, and economical method of joining metals and is used in both repair and manufacturing operations. Welders join metals by applying intense heat and, sometimes, pressure to melt the edges to form a permanent bond. Closely related to welding is "oxygen cutting" (also referred to as flame cutting). Oxygen cutters use torches to cut or trim metal objects to a desired size or shape. Flame or oxygen cutting is also used to remove excess metal from castings and to cut scrap metal into pieces of manageable size.

Of the more than 35 different ways of welding metals, arc, gas, and resistance welding are the 3 most important. *Arc welders* (D.O.T. 4–85.020) perform their work either by hand or machine methods. *Gas welders* (D.O.T. 4–85.030) usually join metals by hand operations, although they also do use automatic and semiautomatic gas welding equipment. Resistance welding is primarily a machine process performed by *resistance-welding operators* (D.O.T. 6–85.010, .020, .030, .060, .100). *Oxygen cutters* (D.O.T. 6–85.215, .240) work with either hand-guided torches or with oxygen-fuel-gas cutting machines.

The principal duty of the welder using the manual technique is to control the melting by directing the heat, either from an electric arc or from a gas-welding torch, and to add filler metal where necessary to complete the joint. In manual shielded metal-arc welding, one of the most commonly used of the arc welding processes, the welder selects a suitable electrode and adjusts controls on power sources which supply the electric current. The welder first "strikes" an arc (draws an electric current) by touching the metal part to be welded with an electrode which also provides the metal filler. By withdrawing the electrode a short distance from the metal part to be welded, an arc is created which bridges the intervening space. After the arc is made, the welder guides the electrode at a suitable distance from the joint seams to be welded. The intense heat caused by the arc melts the metal seams and the electrode tip. The molten metal from the electrode is deposited in the joint and together with the molten metal edges solidifies to form a solid connection.

During the past decade or so, there has been a considerable increase in the use of arc welding processes employing inert gas for shielding the weld area. This type of welding was developed for welding hard-to-weld metals such as aluminum, magnesium, stainless steel, and titanium. Many welders are now specializing in this process.

In gas welding, the welder applies an intensely hot flame (obtained from the combustion of a mixture of fuel gas—most commonly acetylene—and oxygen) from a gas welding torch to the metal edges. After the welder selects the proper types of welding rods and welding torch tips and adjusts the regulators on the oxygen and acetylene cylinders, he lights his welding torch. He then adjusts the oxygen and acetylene valves on the torch to obtain the proper size and quality of flame. The kind of flame selected depends on the type of metal to be joined and the type of joint to be made. The welder heats the metal parts to be welded by directing the flame against

Special clothing and protective helmets guard arc welders against burns and eye injuries.

the metal until it begins to melt. He then applies the welding rod to the molten metal to supply additional metal for the weld.

Resistance-welding operators, unlike hand arc and gas welders who use manual as well as machine methods, operate machines which fuse metal parts by bringing them together under heat and pressure. The operator sets the controls of the machine for the desired electric current and pressure, feeds and alines the work, and removes it after the welding operation is completed. The principal types of resistance-welding equipment are spot, seam, projection, flash, upset, and portable spot welding guns.

In the oxygen cutting process, the operator directs a flame of oxygen and fuel gas on the work area until the metal begins to melt. He then releases an additional stream of oxygen to burn or cut the metal. The operator prepares for the cutting job by attaching the proper torch tip for the particular job, connecting the torch to the gas hoses, and regulating the flow of gases into the torch for the desired cutting flame. He then cuts through the metal, guiding the torch manually along previously marked lines or following a template or pattern. He may mark guide lines on the metal by following blueprints or other instructions. In some cases, the cutting torch or torches are mounted on a machine which, by electronic or mechanical means, automatically follows guide lines.

Where Employed

In late 1958, an estimated 300,000 welders and oxygen cutters were employed throughout the country. Their principal employers were the manufacturers of boilershop and sheet-metal products, motor vehicle and equipment plants, the aircraft industry, the construction industry, and independent metalworking repair shops.

Important employers of arc, gas, and resistance welders were steel mills, metal-stamping establishments, machinery plants, and railroad shops. Federal, State, county, and city government agencies, such as arsenals, road commissions, and departments of public works, also employed many welders. Many manual arc and gas welders were employed in maintenance and repair work in railroad shops, electric power plants, street-railway systems, and in the maintenance shops of manufacturing plants. Resistance-welding operators are employed in production work in automobile manufacturing establishments and other metal working plants where large quantities of identical sheet-metal parts are manufactured. Among the major employers of oxygen cutters were shipyards, steel mills, machinery, and fabricated structural-steel and boilershop product plants.

The widespread use of the welding and cutting processes in American industry enables these workers to find jobs in every State. However, most of these jobs are found in the major metalworking areas, with more than 40 percent of them concentrated in Michigan, Pennsylvania, Ohio, Illinois, and California. Many welders and cutters are employed in Detroit, Chicago, Philadelphia, Los Angeles, and other important metalworking centers.

Training, Other Qualifications, and Advancement

Skills of manual arc and gas welders, resistance-welding operators, and flame cutters vary widely. For most skilled arc- and gas-welding jobs, several years of training and a knowledge of blueprint reading, welding symbols, properties of metals, work planning, electricity, and welding techniques are desirable. Some of the less skilled manual welding jobs can be learned after a short period of on-the-job training.

Welding work requires manual dexterity, a steady hand, good eye-hand coordination, and good eyesight.

Manual welders usually learn their trade by taking a course in welding methods, generally in public or private vocational schools, followed by several years of job experience. A formal apprenticeship generally is not required for this occupation. However, apprenticeship programs for many metal crafts include training in welding as one of the related skills. A few large companies offer apprenticeship programs for welders. The Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees.

The American Welding Society's Code of Minimum Requirements for Instruction of Welding Operators specifies a minimum of 150 hours of actual welding practice and not less than 20 hours of formal instruction in welding theory. Experience has shown, however, that a longer period of training is usually necessary to acquire the basic skills.

Skill requirements for the resistance-welding operator's job depend upon the particular type of equipment used; most of these operators learn their work in a few weeks.

Little skill is required for many flame-cutting jobs and, generally, they can be learned in a few weeks of on-the-job training. However, the cutting of some of the newer alloys requires a knowledge of the properties of metals as well as greater skill in flame cutting.

Young persons entering the welding trade often start with simple manual welding production jobs where the type and thickness of metal, as well as the position of the welding operation, rarely change. Occasionally, they are first given jobs as flame cutters and later move into manual welding jobs. Some large companies employ general helpers in maintenance jobs who, if they show promise, may be given opportunities to become welders.

After serving as a helper to an experienced welder, a young man may be promoted to a job as a semiskilled, class B welder where he will usually perform repetitive work or work which does not involve critical safety and strength requirements. The work duties of the class B welder are primarily performed in only one position (flat, vertical, horizontal, or overhead).

The class A or skilled, all-round journeyman welder should be able to plan and lay out work from drawings, blueprints, or other written specifications. He should have a knowledge of welding properties of steel, stainless steel, cast iron, bronze, aluminum, nickel, and other metals and alloys. He should be able also to determine the proper sequence of work operations for each job and be able to weld all types of joints in flat, vertical, horizontal, or overhead positions. Some skilled manual welders are required to know both arc and gas welding. These craftsmen are usually called "combination welders." The skilled manual arc welder may specialize in one of the many types of arc welding.

Before being assigned to work where the strength of the weld is a highly critical factor, welders may be required to pass a qualifying examination. The test may be given by an employer, by a municipal agency, a private agency designated by local government inspection authorities, or by a naval facility. Certification tests are also given to welders on some construction jobs or to those who may be engaged in the fabrication or repair of steam or other pressure vessels where critical safety factors are involved. In addition to certification, some localities require welders to obtain a license before they can do certain types of outside construction work.

New developments in some manufacturing industries are increasing the skill requirements of welders. This is particularly true in a field such as atomic energy, which has higher standards for reliability of welds and calls for more precise work.

Skilled welders may become foremen who supervise the work of other welders. Occasionally, they may be promoted to jobs as inspectors where they check welds for general conformance with specifications and for quality of workmanship. A small number of experienced, all-round welders establish their own welding and repair shops.

With 2 years' training at a vocational school or technical institute, the skilled welder can qualify as a welding technician. Generally, his duties will be to supervise welders and interpret the engineers' plans and instructions.

Welding also is used widely in maintenance and repair work by workers other than welders. The boilermaker, the structural-steel worker, the machinist, the plumber, and the automobile mechanic all may be required, as part of their job, to know how to weld. Frequently, when welding is used as a repair process, such as in the maintenance shops of large factories, it is done by workers who specialize in welding but who are not classified as welders.

Employment Outlook

The generally favorable longrun outlook in the metalworking industries and the wider utilization of the welding processes are expected to result in a substantial increase in the number of welding jobs in the 1960's. This occupation is expected to expand at a faster rate than will the total labor force in this period. Resistance welding, in particular, is expected to grow rapidly because of the increased use of the machine welding process in such activities as the manufacture of motor vehicles and aircraft, and the production of light, streamlined railroad cars. The anticipated rapid growth in the number of resistance welders will, however, be moderated slightly by the use of more rapid and highly automatic welding machines.

The need for maintenance and repair work in the growing metalworking industries will require many more workers skilled in manual welding. The number of manual welders engaged in production work is also expected to increase in plants manufacturing structural-metal products, such as metal doors, boilers, and sheet-metal products. The construction industry will also need an increasing number of workers skilled in welding as the use of welded steel structures expands. However, the growth in the number of skilled manual arc and gas welding jobs may be slowed somewhat by the increased use of semiautomatic and automatic welding machines which do not require skilled operators.

The number of jobs for oxygen cutters is expected to rise somewhat during the 1960's as the result of the general expansion of metalworking activity. The increased use of oxygen-cutting machines, however, will tend to restrict the growth of this occupation.

Replacement needs resulting from retirements, deaths, and transfers to other fields of work will provide many openings for new workers in the welding and oxygen-cutting field. Retirements and deaths alone will result in about 4,000 to 5,000 openings each year.

Earnings and Working Conditions

The amount a welder can expect to earn depends to a great extent on the skill requirements of his job and on the industry or activity in which he is employed. Earnings of highly skilled manual welders generally compare favorably with those of other skilled metalworking occupations. Resistance welders, who require little training, earn much less than the skilled manual welders.

A wage study of the machinery manufacturing industries made by the Bureau of Labor Statistics in late 1958–early 1959 provides some indication of the level of earnings of welders. The average straight-time hourly earnings of hand welders, class A and B, in the cities surveyed are shown in the following table:

City	Hand welders	
	Class A	Class B
Atlanta	$2.27	$1.99
Baltimore	2.55	2.09
Boston	2.33	--------
Buffalo	2.60	2.38
Chicago	2.59	2.44
Cleveland	2.56	2.33
Dallas	2.03	1.69
Denver	2.49	2.16
Detroit	2.79	2.56
Hartford and New Britain–Bristol	2.41	2.12
Houston	2.62	2.50
Los Angeles-Long Beach	2.64	2.25
Milwaukee	2.73	2.41
Minneapolis-St. Paul	2.41	2.19
Newark-Jersey City	2.78	2.34
New York	2.47	1.99
Philadelphia	2.57	--------
Pittsburgh	2.76	2.52
Portland (Oreg.)	2.61	--------
San Francisco-Oakland	2.88	--------
St. Louis	2.57	2.22
Worcester	2.50	2.27

Average straight-time hourly earnings for skilled (class A) manual welders in the 22 selected cities ranged from $2.03 to $2.88, with the highest rates in San Francisco–Oakland ($2.88) and Detroit ($2.79). Semiskilled (class B) manual welders' average hourly earnings ranged from $1.69 to $2.56.

Many welders and cutters are union members. Among the labor organizations which include welders and cutters in their membership are the International Association of Machinists; the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry.

Many welders and cutters are employed in plants which have labor-management contracts. Most of these agreements provide employees with major benefit programs which may include hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, or a retirement pension.

Welders and cutters are exposed to some hazards in their work. However, safety training and protective devices and clothing have kept the injury rate relatively low. The accidents that do occur almost invariably result from relaxations in safety precautions. Protective clothing, goggles, helmets with colored lenses, and other devices are provided for the safety and protection of the welder. Suitable clothing also protects the welder's skin during the welding process. Although lighting and ventilation are usually adequate, welders occasionally work in the presence of toxic gases and fumes generated by the melting of some metals. Welders are often in contact with rust, grease, paint, and other elements found on the surface of the metal parts to be welded. Resistance-welding operations are largely free from the hazards associated with the hand methods. A clear eye shield or clear goggles generally offer adequate protection to resistance welding operators.

Where To Go for More Information

The American Welding Society,
33 West 39th St., New York 18, N.Y.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington 6, D.C.

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers,
8th at State Ave., Kansas City 11, Kans.

International Union, United Automobile, Aircraft & Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 14, Mich.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada,
901 Massachusetts Ave., Washington 1, D.C.

State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State and/or city in which a person wishes to receive training.

Some Major Industries and Their Occupations

OCCUPATIONS IN THE AIRCRAFT, MISSILE, AND SPACECRAFT FIELD

America's entry into the space age will create thousands of new and interesting jobs. In order to keep pace with new developments in the aircraft, missile, and spacecraft field, increasing numbers of engineers, scientists, technicians, and skilled craftsmen will be needed. By mid-1958, employment in this field already exceeded a million workers.

Engineers, scientists, and technicians make up a much higher proportion of total employment in this area of work than in most manufacturing industries. This is due primarily to the large amount of research and development work required in aircraft and missile production. There are also thousands of jobs for tool and die makers, sheet-metal workers, welders, and mechanics. Many skilled maintenance workers, such as electricians, millwrights, machinery repairmen, and pipefitters are also employed. Training requirements for jobs range from a few days of on-the-job training for some assembly jobs to graduate college work for many scientific jobs.

Nature and Location of the Aircraft, Missile, and Spacecraft Field

The various kinds of aircraft, guided missiles, and spacecraft produced include: Airplanes and helicopters; guided missiles—which range from relatively small rockets carried by and fired from airplanes to much larger models fired from the surface of the earth, from ships, or from submarines; and space vehicles—which may vary in size from a few pounds to thousands of pounds. Gliders, dirigibles, and balloons are also produced.

Many types of engines are manufactured to propel these craft. Spacecraft are powered by rocket engines. Aircraft and missiles may be powered by reciprocating, jet, or rocket engines. In the future, engines driven by atomic energy may be used. The operation of all craft requires a great deal of electronic equipment both in the craft and on the ground. Guidance, control, and armament systems are usually electronic.

About 90 percent of production in this field in 1958 was for defense purposes. Most of the remainder was for aircraft used in commercial air transportation. In addition, many smaller airplanes were produced for business, pleasure, and instructional flying.

The bulk of the workers in this field are in the aircraft and parts manufacturing industry group which employed more than 767,000 workers in December 1958. These workers were distributed among aircraft (end product assembly) plants (462,000), aircraft engine plants (152,000), aircraft parts plants (138,000), and aircraft propeller plants (16,000). There were also an estimated 100,000 workers in the electronics industry in 1958 who were engaged in design and manufacturing activities for aircraft, missiles, and spacecraft. (Occupations in the electronics industry are discussed elsewhere in this Handbook. See index for page numbers.) More than 35,000 workers in the ordnance manufacturing industry were similarly engaged in guided missile work. (Occupations in this industry are similar to those in the aircraft and parts industry.)

Civilian Government employees in the Department of Defense and in the National Aeronautics and Space Administration (NASA) who devote their time exclusively to aircraft, missile, and spacecraft represent another important group in this field. There were more than 50,000 so engaged in the Department of Defense in 1958 and about 8,000 in the NASA. Thousands of additional workers were employed in university operated laboratories engaged in research connected with aircraft, missile, and space problems.

Employment in this field is distributed widely throughout the United States. However, seven States accounted for a large proportion of the workers in 1958: California had about a third of all those employed; another two-fifths were employed in New York, Ohio, Connecticut, Texas, Kansas, and Washington. Some of the metropolitan areas with heavy concentrations of employment were Los Angeles, New York, Seattle, San Diego, Wichita, Hartford, Fort Worth, and Dallas.

How Aircraft and Missiles Are Made

The following brief description of how aircraft, missiles, and spacecrafts are made is presented to give the reader a better understanding of the types of jobs found in this field.

A great deal of research and development work provides the basis for any new design concept for an airplane or missile. Design and developmental work, in the case of military craft, is carried on at laboratory facilities run by the armed services or contracted out either to university research laboratories or to the laboratories of manufacturers. Preliminary design work may include exhaustive tests of a scale model in wind and temperature tunnels and tests of human reaction and structural systems behavior in centrifuges. (A centrifuge facility simulates flight conditions.) After these and many other tests, a full-scale craft may be designed and an experimental or prototype model built. This model undergoes rigorous tests both in the air and on the ground. If the model passes all tests satisfactorily, production contracts are awarded.

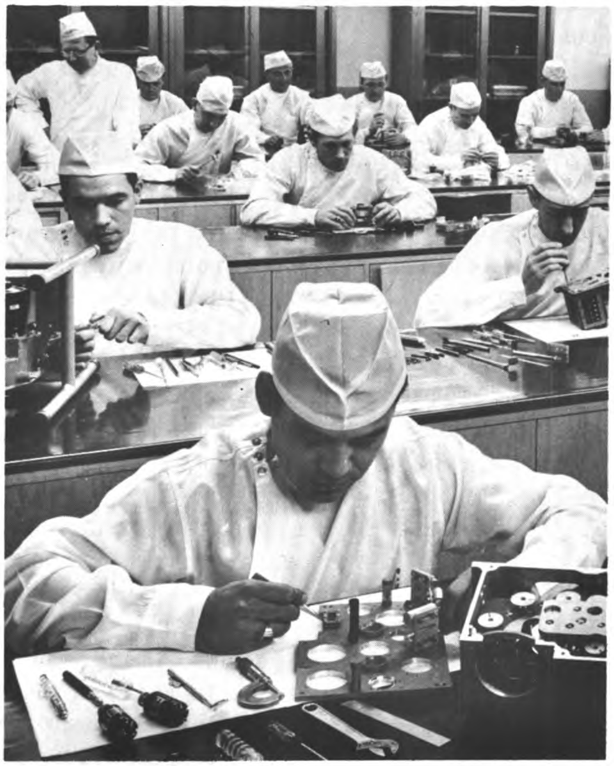
A prime contractor is generally selected to supervise production. The prime contractor is responsible for technical direction of the complete system and may also manufacture and assemble major components of the craft and do the final assembly. (In most cases, the Government agency involved acts as the prime contractor.) The engineering department of a prime contractor furnishes drawings and data to the planning department which is responsible for production plans. Thousands of details required to set production in motion must be worked up. A list is made of tools, machinery, parts, blueprints, materials, and operations required for making each part. Many subcontracts are awarded for the thousands of parts and for some of the assembly work that go into the aircraft or missile. It is estimated that more than 60,000 subcontractors and suppliers provide the thousands of components which are required to produce a completed craft.

Plants producing the major components perform a wide variety of manufacturing operations, such as metalworking, fabrication, and assembly. For example, reciprocating and jet engine plants are essentially precision metalworking establishments. The biggest part of their work consists of machining metal parts with power-driven machine tools. Since they often perform machining operations on metal parts which have been forged or cast, they either maintain their own forge shops or foundries or have their forging or casting work done for them by outside establishments on a contract basis. Plants producing jet engines perform relatively more sheet-metal work and do less machining than plants manufacturing reciprocating engines. Propeller plants, like engine plants, are essentially metal-working shops.

Production begins in the final assembly plant as soon as the machinery and tools are in place, the work force instructed, and materials and parts begin to flow in. In addition to performing assembly work, these plants may fabricate wing, fuselage, and tail sections. This involves the cutting, forming, heating, and processing of stainless steel, aluminum, titanium, and aluminum alloys to produce thousands of different parts. These parts are brought together to form sections of the craft at various bench and floor assembly work stations.

The major assembly of an airplane is performed in the airframe assembly plants. After the fuselage is constructed, the wings and tail are joined to it and the power plant (engine) installed. The auxiliary equipment, such as fuel and hydraulic systems and flight controls, is usually installed during the later stages of assembly. Missiles may be assembled in airframe or electronic plants. After the airframe is constructed, the guidance and control systems are built in and the fuel system and power plant installed. Both airplanes and missiles require extensive riveting, welding, and bolting to join the various sections of the craft together. Before the craft is considered complete, it is "reworked" for last minute engineering changes.

The craft is now ready for test flights. These tests are the last and most searching of the nu-



Precision assemblers working on a missile assembly in an air-conditioned, dust-free room.

merous inspections which occur at every stage of manufacture—from fabrication of components to final assembly.

Testing of missiles is more rigorous than for airplanes since missiles make only one flight and are usually nonrecoverable. Repeated test flights of airplanes provide a great deal of performance information. After the craft passes all tests satisfactorily, it is prepared for delivery.

Occupations in the Aircraft, Missile, and Spacecraft Field

A wide variety of skills are required to design and manufacture aircraft, missiles, and spacecraft. Engineers and scientists with advanced college degrees as well as plant workers who can learn their jobs after a few days or weeks of training are employed. A large number of women (about 165,000 in April 1958) are employed in many types of "white-collar" and factory jobs.

The emphasis upon research and development and the constant changes in design and production methods make this field an important source of jobs for engineers, scientists, draftsmen, and other technical workers. A study of science and engineering in American industry made by the Bureau of Labor Statistics for the National Science Foundation showed that in 1957 the aircraft industry exceeded all other industries in money spent on research and development, in the proportion of its scientists and engineers engaged in research and development activity, and in the ratio of supporting craftsmen used to assist scientists and engineers.

Assemblers, sheet-metal workers, machine tool operators, tool and die makers, mechanics, and inspectors are among the important factory occupations. In addition, large numbers of maintenance workers, such as machinery repairmen, electricians, millwrights, and pipefitters, are employed.

Occupational requirements vary from plant to plant depending on the work being performed. Plants with production contracts for manufacturing airplanes generally have about a fourth of their work force in the scientific, engineering, administrative, and clerical occupations and three-fourths in the plant occupations. Thus, there should be particularly favorable opportunities in these plants for assemblers, inspectors, and sheet-metal workers.

On the other hand, plants with contracts for the development and production of missiles and spacecraft may be very largely engaged in research and development. As a result, the nonproduction worker group (technical and administrative personnel) may include as much as three-fourths of the plant's work force, while the plant worker group will comprise the remaining fourth. In these plants, opportunities are excellent for engineers, scientists, technicians, and mechanics. Good opportunities exist in most final assembly plants for toolroom workers, since these plants generally make a large proportion of the jigs, fixtures, and tools they use.

As in assembly plants, factories manufacturing engines also have differing occupational requirements. Engine plants engaged very largely in production have relatively more factory workers than plants engaged almost wholly in research and development, such as plants developing nuclear-powered engines. Occupational requirements in a particular plant will depend also on the kind of engine in production—reciprocating, jet, or rocket. Thus, in the manufacture of rocket engines, there are relatively more chemists and fewer machine tool operators employed than in the manufacture of jet and reciprocating engines. In a third group of plants—those manufacturing aircraft and missile parts—production rather than research is emphasized and more job opportunities exist for sheet-metal, machine tool, and assembly workers than for professional and technical workers.

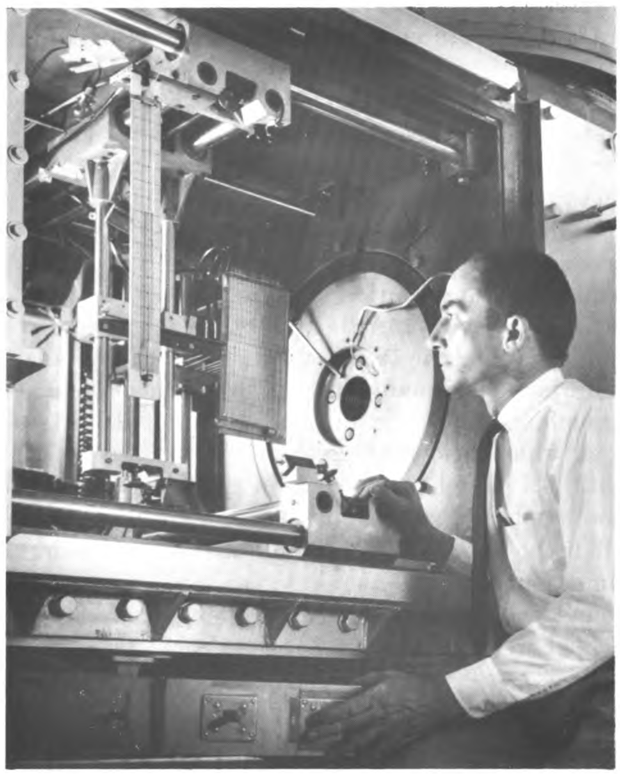
The National Aeronautics and Space Administration and university research laboratories primarily employ scientists, engineers, technicians, and mechanics and very few plant workers. Similar civilian occupational opportunities are found in the armed services. (However, plant worker opportunities do exist at service arsenals.)

The following is a description of some of the individual jobs found in the aircraft, guided missile, and spacecraft field.

Professional and Technical Occupations. Before an aircraft, missile, or spacecraft can be fabricated and assembled, it must be designed and tested, and then its production planned. Engineering and scientific personnel, working in laboratories and in flight test areas and using such research and testing facilities as wind tunnels and ballistic ranges, prepare the plans and specifications for the complete design as well as for the many component parts of the craft. Among the professional people so employed are *aeronautical* (D.O.T. 0–19.03), *civil* (D.O.T. 0–16.01), *electrical and electronic* (D.O.T. 0–17.01), *mechanical* (D.O.T. 0–19.01), and *nuclear engineers* (Temporary D.O.T. 0–19.99); *physicists* (D.O.T. 0–35.73); *metallurgists* (D.O.T. 0–14.20); *chemists* (D.O.T. 0–07.80); *mathematicians* (D.O.T. 0–35.76); *flight physiologists* (D.O.T. 0–26.10); and *engineering psychologists* (D.O.T. 0–36.25). Engineers and scientists are assisted in their work by *engineering aids*, *laboratory technicians*, *research mechanics*, and *electronic technicians*. *Draftsmen* (D.O.T. 0–48.04) develop design plans in detail in the form of blueprints and specifications.

Other engineering personnel specialize in planning the most efficient methods of organizing production. They are concerned with plant layout, selection and installation of machinery, and storage and movement of materials and parts within the plant. Among those engaged in production planning and control are *industrial engineers* (D.O.T. 0–18.01), *production planners* (D.O.T. 0–68.50), and *methods planners* who generally serve as liaison men between the engineering and production departments in a plant. Working from information obtained from blueprints and various kinds of engineering specifications they plan the arrangement of production machinery in the plant and the sequence of operations necessary to fabricate, assemble, and install aircraft and missile parts. Since production planners work on both engineering and production problems, they must be able to apply some engineering principles and also have a working knowledge of shop practices.

Tool designers (D.O.T. 0–48.41) design the tools, jigs, fixtures, and special machines used in fabrication and assembly on the basis of planning information, engineering drawings, and other data. *Technical illustrators* (D.O.T. 0–48.32) and *technical writers* (D.O.T. 0–06.90) produce the



Scientist preparing instruments of a wind tunnel for an experiment.

technical manuals and literature which are used to describe the operation and maintenance of aircraft and missiles and their many parts. They work closely with engineers. (More detailed discussions of individual professional and technical occupations are given elsewhere in this Handbook. See index for page numbers.)

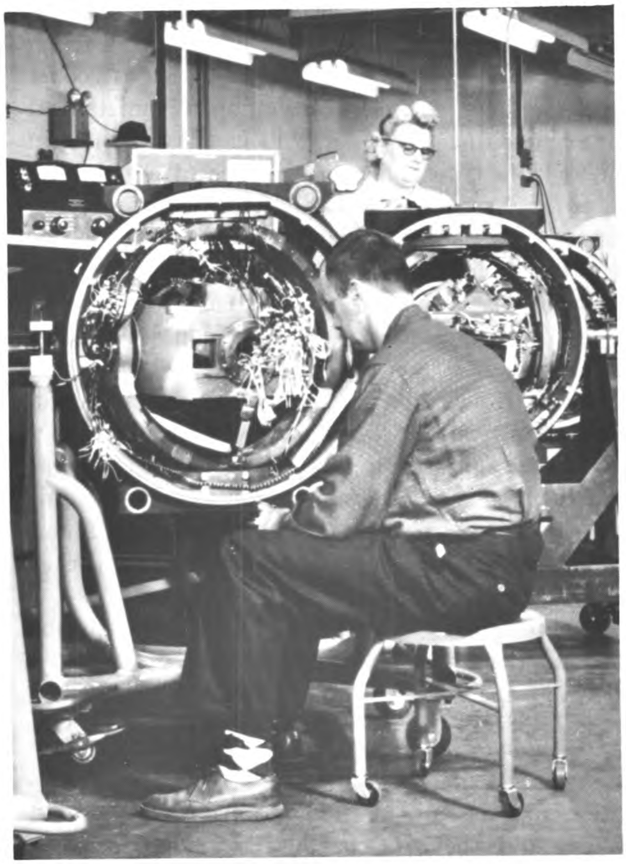
Administrative, Clerical, and Related Occupations. Managerial and supervisory jobs are generally comparable to similar jobs in other industries. Personnel in these jobs include executives, who are responsible for the management and supervision of research and production operations, and officials in such departments as sales, purchasing, accounting, public relations, advertising, and industrial relations.

Many thousands of clerks, secretaries, typists, stenographers, tabulating machine operators, and other office personnel are also employed. (Duties in these jobs are similar to those in other industries and are described elsewhere in this Handbook. See index for page numbers.)

Plant Occupations. More than 60 percent of the workers in the aircraft, guided missile, and spacecraft field were employed in plant jobs in mid-1958. Plant jobs can be classified into the following groups: assembly and installation, sheet metal, tool fabrication and machining, other metal processing, inspecting and testing, flight line checkout jobs, maintenance and custodial, and all other plant jobs.

Assembly and installation occupations. Assembly and installation workers are a major occupational group. Although these workers are employed in practically all aircraft and missile manufacturing plants, the highest proportion of assemblers are found in final assembly plants.

A wide variety of assembly jobs exists, even within a single plant, because assembly is really not a single occupation, but a family of jobs, all having the same general purpose and using similar methods. Some assemblers are skilled, all-round workers, but a large proportion are semiskilled workers doing repetitive work. The more skilled assemblers perform diversified assembly or installation work. They must be able to read blueprints and interpret other engineering specifications. The all-round assembler is usually employed in final assembly work where major



Assembly workers building missile inertial guidance systems.

subassemblies are fitted together and the major installations are made. They are also employed in producing prototypes and experimental craft.

The division of duties among assemblers in a particular plant depends largely on the organization of the production line. Plants which are producing large numbers of aircraft and missiles, rather than a few experimental types, usually require even their skilled assemblers to specialize in one or more fields of work. They are often assisted by less skilled assemblers who do the routine work. For example, a *class A armament assembler* (D.O.T. 5-83.543) typically does such work as assembling, installing, and alining power turrets, weapons, gun cameras, and related accessories. Lower rated armament assemblers typically do such work as uncrating and cleaning weapons, loading ammunition, installing armor plate, and placing parts in jigs. Skilled *electrical assemblers* (D.O.T. 4-97.910), sometimes called electricians, do such work as installing, hooking up, and checking major units in electrical or radio systems. They are assisted by less skilled assemblers, who do the more routine installations and wire routings by following standard wiring diagrams and charts. *Power plant assemblers* (D.O.T. 5–03.572), sometimes known as engine mechanics, install, aline, and check the various types of engines and accessories. Assemblers also specialize in plumbing, hydraulic, and various surface control and rigging systems.

Assemblers who work on experimental, prototype, or special craft are usually highly skilled mechanics. They must be able to assemble, disassemble, inspect, and install complex mechanical and electronic assemblies. They may be called *final assemblers* (D.O.T. 5–03.572) or, more specifically, *missile assembly mechanics* (Temporary D.O.T. 5–03.599), *rocket assembly mechanics* (Temporary D.O.T. 5–03.699), and *reactor assembly mechanics.*

Sheet-metal occupations. Sheet-metal workers shape aircraft and missile parts from sheet metal by hand or machine methods. Where hand methods are used, the worker shapes the part by pounding it with a mallet and by bending, cutting, and punching it with handtools. Machine methods involve the use of power hammers and presses, saws, tube benders, and drill presses. The all-round *sheet-metal worker* (D.O.T. 4–80.050 and .060) lays out the sequence of operations from blueprints and other engineering information. He then fabricates complicated metal shapes by hand or power machine. Less complex parts, as well as those which are produced in large numbers, are fabricated by less skilled sheet-metal workers or workers who specialize in operating a single machine. They have such titles as *stretch press operator* (D.O.T. 4–88.627), *power brake operator* (D.O.T. 6–94.207), *power hammer operator* (D.O.T. 6–94.221), *power shear operator* (D.O.T. 6–88.664), *punch press operator* (D.O.T. 6–88.622), and *profile cutting torch operator* (D.O.T. 6–85.240).

Tool fabrication and machining occupations. Although the total number of workers employed in tool fabrication is not large compared with other operations in aircraft and missile production, tool fabrication is one of the major operations requiring skilled workers. The two principal occupations in tool fabrication are *jig and fixture builders* (D.O.T. 5–17.060) and *tool and die makers* (D.O.T. 4–76.010, .040, and .210). Jig and fixture builders make the work-holding and tool-guiding devices used in production and assembly operations. These skilled workers must be able, based upon information received from the engineering department, to plan a sequence of metal machining operations involved in making a jig. They must be able to lay out the work and carry the job through to completion. Tool and die makers make the cutting tools and fixtures used in machine tool operations and the dies used in forging and punch press work. They must be all-round experts in the use of machine tools.

Another large group of workers engaged in shaping and finishing metal parts with machine tools are *machinists* (D.O.T. 4–75.010) and *machine tool operators.* These workers make up a greater proportion of the work force in engine and parts plants than in final assembly aircraft and missile plants.

The most skilled among these workers are the all-round or general machinists who can lay out the work and set up and operate several types of machine tools. They perform machining operations of a highly variable and nonrepetitive nature. They are most frequently employed in departments which are engaged in experimental and prototype production.

Machine tool operators are employed in the large volume production of metal parts. They generally specialize in the operation of a single type of machine tool. The more skilled machine tool operators are able to set up the work on their machine and handle difficult, precise, and variable jobs. The less skilled operators usually do more repetitive work. (A more detailed discussion of tool and die makers, machinists, and machine tool operators is given in the section on machining occupations. See index for page numbers.)

Other metalworkers, such as tube benders, riveters, and welders are also employed. The *tube benders* (D.O.T. 6–95.060) form tubings which are used for oil, fuel, hydraulic, and electrical conduit lines. *Riveters* (D.O.T. 6–95.080) and *welders* (D.O.T. 4–85.020, .030, .040, and .063) join fabricated parts together by hand or machine riveting and by electric arc, gas, or electric resistance welding.

Other metal processing occupations. A great number of aircraft, missile, and spacecraft parts are chemically and heat treated during several stages of their manufacture in order to clean, change, or protect their surface or structural condition. Sheet-metal parts are heat treated to keep the metal soft and malleable while it is being worked into the required shape. Many processes, such as painting and plating, are used on the surfaces of parts. Workers in these metal-processing jobs have such job titles as *heat treater* (D.O.T. 4-87.020), *painter* (D.O.T. 5-16.940), and *plater* (D.O.T. 4-74.010).

Inspecting and testing occupations. Because aircraft and missiles are extremely complex, thousands of inspections must be made during their manufacture. Raw material is inspected as it is received in the plant and additional inspections are made as it moves through the many fabricating and assembly operations. Extensive inspection of work at manufacturing plants is also carried out by civilian employees of the armed services.

The inspector's job is to examine the parts and assembled units of the craft in each stage of its manufacture to see that all engineering requirements have been met. Some inspectors specialize in examining materials, parts, equipment, or subassemblies purchased from the outside; others inspect parts during various stages of fabrication and final assembly within their own plants; while still others inspect the completed craft after it has been rolled out of final assembly.

Some of the most skilled inspectors, especially in aircraft and missile assembly plants, are the *outside production inspectors* (D.O.T. 4-76.220) who examine machine parts, subassemblies, and tools and dies which have been ordered from other firms. They also serve as liaison men between their own engineering departments and the contracting companies. Other inspectors, frequently known as *receiving inspectors* (D.O.T. 7-03.810), with less responsibility than outside production inspectors, check purchased materials and parts for conformity with blueprints; Air Force, Army, and Navy requirements; and other established standards. They operate testing equipment and must be familiar with specifications of the parts and materials purchased from different sellers. *Machine parts inspectors* (D.O.T. 4-78.671) in the production department determine, by the use of precision testing instruments, whether or not a part has been properly machined to conform to blueprint specifications. Their duties may also include testing for hardness and porosity, checking the finished parts against the rest of the assembly, and determining the "machineability" of castings and forgings.

Fabrication inspectors (D.O.T. 5-03.812) are generally former skilled sheet-metal workers. These workers inspect fabricated sheet-metal work, examine first-run assemblies and developmental parts, and make the final inspection of complex parts which have required numerous fabricating operations.

As the parts are fitted together, they undergo numerous inspections by the *assembly inspector* (D.O.T. 5-03.814). Assembly inspectors are employed, for the most part, in the later stages of the assembly process. They usually inspect complete major assemblies and installations, such as fuselage, wing, and nose sections, to insure their proper final fitting. They also check the functioning of such systems as hydraulics, plumbing, and controls. Subassemblies are usually inspected by less skilled assembly inspectors.

Flight line checkout occupations. Aircraft and missiles are prepared for flight after final assembly operations are completed. Highly skilled workers look for flaws in the construction or functioning of the craft (if necessary, they make repairs or return craft to plant for repairs). Some of these workers are temporarily assigned as service mechanics to military bases to instruct military personnel in the servicing of new model aircraft or missiles.

The job of preparing an aircraft or missile for its flight requires a team of mechanics with different levels of skill and experience. The *chief mechanic* or *crew chief*, who is the most skilled among these workers, is responsible for the entire checking-out operation and repair work. He usually directs the work of a crew of mechanics, each of whom specializes in one or more fields. For example, *engine mechanics* specialize in checking out the power plant, including the engine, propellers, and oil and fuel systems. When possible, the power plant is subjected to various tests during operation to determine whether it is operating correctly. Engine mechanics use handtools, testing equipment, and precision measuring instruments in their work. The *electronics checkout* *men* perform or supervise the final operational checkout of such systems as radio, radar, automatic pilot, fire control, and complete electronic guidance systems.

Flight line mechanics may also specialize in the checking out and repairing of armament, instruments, rigging and controls, and the plumbing and hydraulic systems. In some cases, less skilled mechanics are employed to assist the specialized mechanics in conducting their tests and making minor repairs.

Maintenance and custodial occupations. Maintenance workers are employed to keep machinery, equipment, and buildings in good operating condition and to make changes in the layout of the plant. Included among these workers are *maintenance mechanics*, *millwrights*, *electricians*, *carpenters*, *plumbers*, and *pipefitters*. *Guards*, *firemen*, and *janitors* comprise the plant's protective and custodial group.

Other plant occupations. There are many additional metal and processing workers in aircraft and missile manufacturing other than those previously mentioned. For example, *chemical millers* (Temporary D.O.T. 4–73.999) etch metal parts into desired shapes by applying chemical solutions to appropriate sections. The *metal honeycomb processor* (Temporary D.O.T. 4–80.999) cuts, shapes, and fits metal honeycomb sections and assemblies into aircraft. These honeycomb sections provide exceptional strength for aircraft structures.

Additional metal fabricating is performed by such skilled foundry workers as *patternmakers*, *molders*, and *coremakers*. *Drop hammer operators* and other forge shop workers are found in the forging departments. Plants also employ *tool crib attendants* and *stock clerks* to keep the production workers supplied with tools, parts, and materials. (Detailed discussions of maintenance, foundry, and forge shop occupations are included elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences is generally the minimum requirement for engineering and scientific jobs. For some scientific jobs—particularly those in the area of research and development work—advanced degrees or the equivalent in work experience are needed. (Detailed discussions of the training and other qualifications for individual engineering and scientific occupations are presented elsewhere in this Handbook. See index for page numbers.) Many college graduates without previous experience are hired for these jobs and are given additional training in company-sponsored training programs. Some companies offer technical instruction at their own plants or at nearby colleges to fit new employees into their organization or to give further training to personnel already employed. Some companies reimburse engineers and other technical workers for tuition costs of specialized technical courses taken at local colleges or universities. In addition, companies have management development programs to train their technical and other personnel for supervisory and executive positions. The armed services have similar programs.

Thousands of semiprofessional workers, such as production planners, tool designers, electronic technicians, engineering aids, and draftsmen are employed in the aircraft, guided missile, and spacecraft field. In many cases, these workers are trained in 2-year technical institute or junior college programs sponsored by the companies. Some skilled tool, experimental, and production designers or planners become qualified through several years of diversified shop and tool planning experience rather than through formal technical training. However, it is becoming more common for these workers to have at least 2 years of formal training.

The training requirements for plant jobs vary from a few days of on-the-job training to 4 or 5 years of formal apprenticeship training. Some firms have apprenticeship programs for such skilled occupations as tool and die makers, machinists, sheet-metal workers, aircraft mechanics, electricians, patternmakers, and electronic technicians.

During the apprenticeship period, which generally lasts about 4 years, the apprentice works with the tools of his trade, doing work of progressively increasing difficulty. In addition to work experience, the apprenticeship programs usually include related classroom instruction.

According to the U.S. Department of Labor's Bureau of Apprenticeship and Training, virtually all plants in the aircraft and missile field have planned training programs. However, most plants stress short-term programs to meet immediate skill needs, rather than programs of longer duration, such as apprenticeship. In addition to depending upon planned training programs as a source of skilled labor, plants also fill their skilled jobs by upgrading workers who have picked up the skills of their trade by working with experienced craftsmen.

Many levels of training and experience are also required for other factory jobs. For example, workers with little or no previous training or experience are hired for the less skilled assembly jobs. On the other hand, some skilled assemblers are required to have from 2 to 4 years of plant experience in addition to the equivalent of a high school or vocational school education. These skilled assemblers must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations. Many firms give short-term courses to assembly workers to teach them to read blueprints and schematic diagrams.

The kind and length of training required for inspection jobs depends largely on the manufacturing operations in which the inspecting is being done. Customarily, the more skilled inspectors gain their basic experience and training in one of the aircraft and missile manufacturing shop trades. For the less skilled inspection jobs, new workers with limited or no experience in shop trades may be hired and trained directly as inspectors.

The highest skilled inspectors who examine the parts manufactured by outside suppliers and parts machined in their own plant must have had at least several years of machine shop experience. Skilled inspectors must also be able to install and use various kinds of testing equipment and instruments. As part of their duties, these inspectors must be able to read blueprints and other engineering specifications and use shop mathematics. Many new workers are taught blueprint reading and shop mathematics in training programs conducted or sponsored by the companies.

Chief flight line and airport mechanics are usually required to have from 3 to 5 years of aircraft or missile manufacturing experience, including at least 1 year as a field and service mechanic. Specialized mechanics, working under the supervision of the chief mechanic, are usually required to have 2 or more years of experience. Workers with little or no experience in this field are sometimes hired as helpers or assistants to specialized mechanics and pick up the mechanics' skills on the job.

Mechanics, especially chief mechanics, frequently acquire most of their experience in production departments before becoming flight line and airport mechanics. Workers can qualify for the field and service mechanics jobs in different ways. They can take a beginning job as a less skilled mechanic and may advance as they gain experience. Those who have completed high school or vocational school may be eligible for training jobs which are offered by some of the plants. The higher rated jobs are also sometimes filled by experienced "line maintenance" mechanics who have worked for commercial airlines.

Employment Outlook

Employment opportunities in the aircraft, missile, and spacecraft field in the 1960's will depend largely on the volume of Government expenditures for military craft and for civilian space research. Unless the international situation should change substantially from that which prevailed in the fall of 1959, there probably will be increasing expenditures for military and civilian space research and for many kinds of craft. This will result in an increasing need for more workers. In addition, thousands of job openings will result from the need to replace workers who retire, die, or transfer to other industries. There will be about 15,000 job openings annually just to replace those who retire or die.

During the 1960–70 decade, it is expected that appropriations for guided missiles will probably make up a larger percentage of the military budget than they have in the past. Government expenditures for space research will probably increase proportionately more than those for guided missiles. Although employment in plants producing military airplanes is likely to decline somewhat in the next few years, employment increases for missile and spacecraft work is expected to more than offset this decline. Employment is expected to increase somewhat during this period in the production of civilian aircraft, both for business flying and for commercial transportation—particularly because of orders for new jet commercial airplanes.

The overall employment picture will be uneven. For example, plants manufacturing guided missiles will offer relatively more job opportunities than those manufacturing piloted airplanes, and plants manufacturing rocket engines will offer more employment opportunities than those manufacturing jet and reciprocating engines. Excellent job opportunities will exist in university research laboratories, in the National Aeronautics and Space Administration, and in the Departments of the Navy, Army, and Air Force.

Since research and development will remain an important and growing activity, employment opportunities for all types of engineers, scientists, production planners, tool designers, electronic technicians, technical illustrators and writers, and mechanics will be very favorable—particularly in those plants engaged in guided missile and space work. Opportunities will also exist for assemblers, machine tool operators, sheet-metal workers, and inspectors as production of guided missiles and space vehicles increases. Additional maintenance and repair workers will be needed to maintain the more complex and growing volume of machinery and equipment used in aircraft and guided missile research and manufacturing work.

Earnings and Working Conditions

Plant workers' earnings in aircraft companies exceed those in most other manufacturing industries. In April of 1959, production workers in aircraft and parts manufacturing plants earned an average of $105.41 a week or $2.59 an hour, according to the Bureau of Labor Statistics. This compared with an average of $89.87 a week or $2.23 an hour for all manufacturing industries in the same month. The Department of Defense agencies pay wages generally comparable to those paid by private employers.

Little information is available on the earnings of professional and technical personnel in the aircraft, missile, and spacecraft field. However, general earnings information for many of these occupations is included in the sections on individual occupations in this Handbook. (See index for page numbers.)

The following tabulation is based upon data collected from a number of representative aircraft and missile manufacturers. It indicates the general range of hourly rates for selected occupations in mid-1958:

Aircraft mechanics	$2.35–$2.70
Assemblers	1.60– 2.50
Draftsmen	1.75– 2.35
Electronic technicians	2.10– 3.05
Inspectors and testers	1.80– 2.95
Jig and fixture builders	2.30– 2.95
Laboratory technicians	2.00– 2.90
Machine tool operators	1.80– 2.70
Machinists	2.25– 2.90
Maintenance craftsmen	1.90– 2.90
Tool and die makers	2.10– 2.95
Tool designers	2.20– 3.15
Welders	1.95– 2.75

Workers in this field generally receive 2 weeks vacation with pay after 1 year of service and 3 weeks after 12 or more years. The majority of firms give their employees 6, 7, or 8 paid holidays a year. Workers are usually covered by medical, hospital, health, accident, life insurance, and pension plans. Employees of the Department of Defense receive fringe benefits which compare favorably with those received by workers in private plants. Most union contracts include a provision under which wages are adjusted according to changes in the cost of living.

Most employees work in modern factory buildings which are clean, well lighted, and well ventilated. Some employees work outdoors. This occupational field compares favorably with other manufacturing industries as a safe place to work. Efforts of safety departments and joint labor-management safety committees have reduced the number of injuries in recent years. In 1957, the aircraft industry averaged 2.7 disabling injuries for each million employee hours of work. This compares with an average of 11.4 for all manufacturing industries.

A very large proportion of production workers in aircraft and missile manufacturing are union members. The International Association of Machinists and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America represent most of the union workers. Several independent unions also have contracts with aircraft and missile plants. In ad-

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dition, some guards, truckdrivers, and craftsmen belong to unions representing specific occupational groups.

Where To Go for More Information

National Aeronautics and Space Administration,
1520 H St. NW., Washington, D.C.

Aircraft Industries Association of America, Inc.,
15th and H Sts. NW., Washington 5, D.C.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington 6, D.C.

International Union, United Automobile, Aircraft & Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 14, Mich.

AIR TRANSPORTATION OCCUPATIONS

The air transportation industry has become one of the Nation's major passenger transportation industries in the period since World War II. The 25.5 billion domestic passenger miles flown by the scheduled airlines in 1958 was about three times the mileage flown in 1950 and greater than the intercity passenger miles traveled by either the railroads or the motor buses. The industry provides employment for workers in a variety of interesting and responsible jobs. Some of these jobs, such as pilots and stewardesses, are especially appealing to young men and women.

Nature of the Industry

The scheduled airlines (those which operate regularly scheduled flights over prescribed routes) employed over 150,000 air transportation workers in late 1958. Twelve of the 49 scheduled airlines which were operating at the close of 1958 were large domestic trunk lines which provided regular service over heavily traveled routes connecting large metropolitan areas. Nine of these large airlines also operated international routes. Eight other airlines were engaged exclusively in international operations. Another 13 companies were domestic local service airlines which connected the major traffic centers with cities off the main routes. In addition, seven carriers operated only between the mainland and Hawaii or Alaska; six airlines handled cargo exclusively; and three others offered helicopter services in three major United States cities between airports and downtown areas.

Some 30 nonscheduled airlines, which were operating in late 1958, employed only about 3,000 workers. (Twenty-three of these airlines, which received temporary certificates as "supplemental" carriers in early 1959, operated a limited number of scheduled flights each month.) A few of the larger nonscheduled companies were located in large metropolitan centers and flew along the same routes used by the scheduled airlines. The majority, however, were small companies which operated charter flights between communities off the main airline routes.

The rules and regulations governing the operation of air transportation in the United States are established and enforced by the Civil Aeronautics Board (CAB) and the Federal Aviation Agency (FAA)—both agencies of the United States Government. The CAB establishes policy concerning such matters as airline rates and routes and investigates accidents. The FAA develops safety regulations, inspects and tests airplanes and airline facilities, gives tests, and licenses some personnel. Several hundred experienced pilots, aeronautical engineers, and airplane mechanics are among the personnel employed by these agencies to investigate accidents and make safety inspections.

The FAA also operates the Federal Airways System, a network of designated lanes through the air space along which aircraft are guided from airport to airport by an elaborate system of radio and radar controls. The System employs traffic control specialists who provide information and guide planes using the airlanes.

FAA personnel are predominantly civilian Federal employees whose major function is to serve the air transportation industry. In early 1959, the FAA employed more than 28,000 workers.

The Defense Department employed about as many aircraft mechanics as did the scheduled airlines. Other government agencies employed a few pilots, mainly for patrol work.

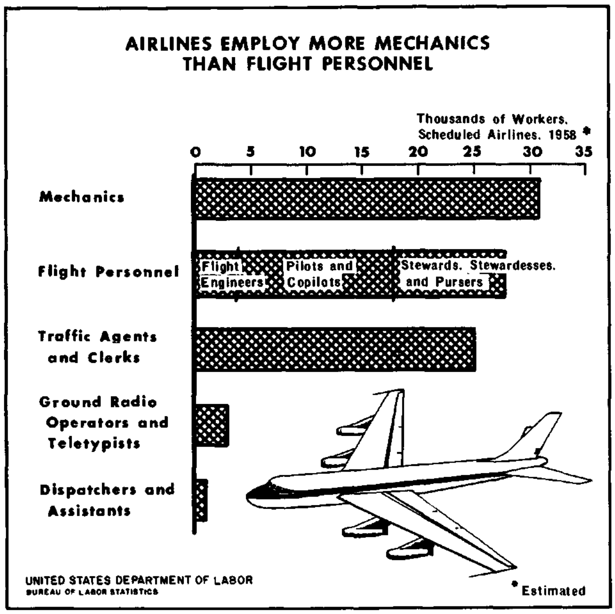
In addition to the personnel employed by airlines and by the Federal Government, thousands of other workers are employed in the field of commercial flying. Most of these workers are employed by independent aircraft and engine repair firms and by "fixed-base operators," who run flying schools; do agricultural work such as crop dusting, spraying, and seeding; aerial photography; and advertising through sky writing. In 1957, over 4,000 pilots including pilot-owners, were engaged in the agricultural work alone. Some pilots also work for oil companies, patrolling pipelines and assisting in exploration. Many other pilots and maintenance personnel work for companies that operate their own airplanes to transport their executives.

Air Transportation Occupations

The transportation of passengers and cargo by air requires a great many skilled workers to fly the planes, maintain and repair the equipment, provide services to passengers at terminals and during flights, and perform ordinary business services. Flight personnel made up almost 20 percent of scheduled airline employment in 1958. (See chart 32.) Twenty-five percent were mechanics and other maintenance and repair personnel. About 17 percent were traffic agents and clerks. Some 3 percent worked at airline ground stations as communications personnel and dispatchers. The remainder (about 35 percent) were cargo and freight handlers, aircraft-servicing personnel, office workers, and administrative and professional personnel.

Flight crews consist of pilots, copilots, flight engineers, flight attendants (stewardesses and stewards), and sometimes navigators. All commercial airline flights have a captain and a copilot who operate the aircraft. Many domestic and most international flights also have a flight engineer on board to see that the engines, gages, and controls operate satisfactorily and to take proper emergency measures in flight. Navigators are carried on flights over water to aid the pilot in navigating and maintaining communications. Almost all passenger flights carry stewardesses or stewards.

CHART 32



Ground operational personnel consist of workers such as dispatchers, controllers, and radio operators who assist flight crews by communicating with them from bases on the ground. Dispatchers guide and give flight information to all planes operated by their company and flying within a given radius of their airport. Air-route and airport traffic controllers, employed by the FAA, give landing and takeoff clearances and navigational information to all planes operating within their areas of control. Meteorologists interpret and analyze weather information and report their findings to dispatchers who use this information to make decisions on flight operations. Radio operators and teletypists assist both dispatchers and controllers by making direct connections with the planes and relaying messages to flight crews and to other airports.

Mechanics see that planes are in good condition before each flight, do emergency repair jobs, and overhaul and recondition aircraft and engines at periodic intervals. Stock and store clerks receive, store, issue, and keep records of the thousands of parts and supplies kept at aircraft maintenance bases.

A detailed description of the duties, training, qualifications, employment outlook, earnings, and working conditions for each of the following air transportation jobs appears in the later sections of this chapter: (1) pilots and copilots, (2) flight engineers, (3) stewardesses, (4) airplane mechanics, (5) traffic agents and clerks, (6) airline dispatchers, (7) air traffic controllers, and (8) ground radio operators and teletypists.

Employment Outlook

Total employment in air transportation is expected to remain relatively stable during the early 1960's. Nevertheless, because of the high turnover in some occupations, there will be many opportunities for new workers to obtain jobs in these occupations. In the latter part of the decade, the combination of an anticipated increase in total employment and continuing replacement needs will result in many more job opportunities for young men and women.

Airline traffic and employment have grown rapidly during most of the industry's brief history. Over the past quarter of a century, the revenue of passenger miles flown by the scheduled domestic and international airlines increased more than 150 times—from about 200 million in 1934 to more than 31 billion in 1958. Over the same period, employment increased 23 times—from about 6,500 in 1934 to more than 150,000 in 1958.

Air traffic is expected to continue to grow rapidly in the 1960's. The FAA has estimated that the scheduled airlines by 1970 will fly at least twice the revenue passenger miles flown in 1958. A larger population, increased consumer purchasing power, the trend toward longer vacations, the greater dependence upon air travel by businessmen, faster flights on jet aircraft which will save time in long-distance travel, and more low-cost air coach service in medium-distance flights are among the factors which will result in greatly increased air travel. An even larger increase is expected in air cargo traffic, which, however, represents a relatively small percentage of total traffic. Continued growth in agricultural, pipeline inspection, patrol, and other commercial flying services is also expected.

In 1958, the airlines had already acquired a major share of the Nation's long-distance common-carrier passenger travel, and it is believed they will obtain an even larger share in the future, as well as a larger share of the medium-distance travel market. Low-cost air coach service, which has greatly increased long-distance air travel, has been offered on only some medium-distance flights. When this service is expanded, it should also add to the increase in total airline traffic. In short-distance travel, however, the airlines are not expected to increase their share of the passenger traffic.

As in the past, employment is not expected to increase at as fast a rate as traffic. Faster, bigger, and more efficient planes and other equipment will make it possible to carry more passengers per airline employee in the future. With the transition to pure jet and jet-powered propeller planes, the large scheduled airlines will probably be able to carry up to twice as many passengers at one and a half times the speed of the largest piston-engine planes now in service. The local service airlines are also expected to replace much of their equipment with turboprop planes and the larger piston aircraft now used by the major airlines. Expanded air coach service should also enable airlines to handle more traffic without a comparable increase in employment.

Furthermore, the greater use of electronic data-processing systems, now being introduced, will enable airlines to handle a much greater volume of reservations, scheduling, and accounting operations without a comparable expansion in clerical employment. Mechanical equipment such as conveyors will also permit the airlines to handle more baggage and cargo without additional cargo and baggage handlers.

Despite the introduction of more efficient planes and equipment, overall airline employment is expected to increase during the latter part of the 1960's because of the anticipated growth in traffic. Throughout the entire 1960's, there will be many opportunities for new workers in airline jobs which have high turnover rates—such as, stewardesses and traffic agents and clerks. There will also be increasing opportunities for air traffic controllers.

Earnings and Working Conditions

Skill requirements, length of experience, amount of responsibility for safe and efficient operations, and many other factors affect the earnings of air transportation workers. The statements on individual occupations which follow contain detailed discussions of earnings for each of the major occupations.

Most companies give free transportation in domestic travel on their own flights to employees and their immediate families and have reciprocal arrangements with other airlines providing for greatly reduced travel rates. In overseas travel, employees and their immediate families receive discounts of up to 90 percent. Flight personnel may be away from their home bases about a third or more of the time. When they are away from home, the airlines either provide living accommodations or pay actual expenses.

Air transportation is an industry that operates around the clock, with flights scheduled for all hours of the day and night. Flight personnel, therefore, often have irregular work schedules. Maximum hours of work per month for these workers have been established by the FAA as a safety precaution against fatigue. In addition, union agreements often stipulate that persons in flight occupations be paid for a minimum number of hours per month to guarantee a substantial proportion of their normal earnings.

Ground personnel—including dispatchers, mechanics, traffic agents, communications operators, control personnel, and administrative personnel—usually work a 5-day, 40-hour week. Their working hours, however, like those of flight personnel, often include nights, weekends, or holidays. For overtime work, they generally receive premium pay.

In domestic operations, employees usually receive 2 or 3 weeks' vacation with pay, depending upon length of service. Most flight personnel in international operations get a month's vacation. Employees also receive paid sick leave and retirement, insurance, and hospitalization benefits. FAA employees receive the same benefits as other Federal personnel, including from 13 to 26 days of vacation leave and 13 days of sick leave a year, as well as retirement and insurance benefits.

Many of the workers in air transportation are union members. These unions are mentioned in the sections covering the individual jobs.

Where To Go for More Information

To find out about openings in a specific airline and the special qualifications required, one should write to the personnel manager of the line. Addresses may be obtained from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington 6, D.C.

Inquiries regarding jobs with the Federal Aviation Agency should be addressed to the Personnel Officer, Federal Aviation Agency, at any of the following addresses:

Region 1. Federal Building, New York International Airport, Jamaica, Long Island, N.Y.
Region 2. Box 1689, Fort Worth, Tex.
Region 3. 4825 Troost Ave., Kansas City, Mo.
Region 4. 45007 Airport Station, Los Angeles, Calif.
Region 5. Box 440, Anchorage, Alaska.
Region 6. Box 4009, Honolulu 12, Hawaii.
Aeronautical Center, Box 1082, Oklahoma City, Okla.

Information on FAA-approved schools offering training for work as an aviation mechanic or pilot and in other technical fields related to aviation may be obtained from:

Correspondence Inquiry Branch, W-126,
Federal Aviation Agency, Washington 25, D.C.

Pilots and Copilots

(D.O.T. 0-41.10 and .12)

Nature of Work

A keyman in air transportation is the pilot, who operates the controls and performs other tasks necessary for getting a plane into the air, keeping it on course, and returning it safely to earth. The pilot operates the radio, supervises navigation for the flight, and keeps close watch on the many instruments which indicate the condition of the engines, fuel, controls, electronic equipment, and landing gear. In performing these duties, the pilot applies his knowledge of meteorology, methods of navigation, and flight procedures.

There are two pilots—a captain and a copilot—on all scheduled airline flights. The captain is fully responsible for the aircraft and its passengers and cargo. He is commander of the flight crew which may include, in addition to the copilot, a flight engineer, a navigator, and flight attendants. The copilot, or first officer, is second in command and also operates the controls of the plane.

Both captain and copilot also have extensive ground duties. Before each flight, they confer with the company meteorologist about weather conditions and prepare a flight plan in cooperation with the airline dispatcher. The captain decides which of several approved routes and altitudes offer the best weather and wind conditions to assure a safe, fast, and smooth flight. The copilot plots the course to be flown and computes the flying times between various points. When completed, the flight plan must be approved by FAA flight control personnel. Just prior to takeoff, the pilots check the operation of each engine and the functioning of the many instruments in the cockpit.

During the flight, the pilot reports, by radio, flight details and actual weather conditions to ground control stations. The copilot records the

Flight crew receiving training in operation of jet aircraft.

progress of the flight along its course and also keeps close watch on all instruments and gages.

Before landing, the pilots recheck the operation of the landing gear and request, by radio, clearance for landing from the airport control tower. In bad weather, they may have to land entirely by instruments. When the flight is ended, the pilots complete a flight report and file trip records in the airline office. The duties of pilots are much the same in both the scheduled and the large nonscheduled airlines.

Some pilots are employed as "check pilots" by the airlines. They make at least two flights a year with each pilot to observe his proficiency and adherence to FAA flight regulations and company policies. Airlines also employ pilot-instructors to train new pilots, as well as to train experienced ones in the use of new equipment. Some pilots are employed by the airlines to fly planes leased to private corporations.

Scheduled airlines employed about 11,200 pilots and copilots in domestic operations in 1958. The major trunk airlines employed about 9,600 of these workers and 1,600 were employed by local service carriers and metropolitan helicopter airlines. An additional 600 pilots worked for scheduled all-cargo carriers. Another 2,100 were employed on scheduled international flights. In addition, approximately 800 pilots were employed by the large nonscheduled airlines.

An increasing number of pilots fly aircraft owned or leased by business firms to transport their company officials. A small number are test pilots for aircraft manufacturers, and a few do aerial inspections over pipelines and installations for oil companies. In addition, a considerable number of pilots, many of whom are self-employed, perform one or more aviation services such as crop dusting, private flight instruction, air-taxi operations, charter passenger and cargo services, sightseeing flights, aerial photography, and sky writing.

Pilots not employed by the airlines usually fly smaller and less complex aircraft than do airline pilots and seldom have the assistance of flight crews. In addition to flying, they may supervise or perform the maintenance work on their planes. Those who are self-employed also have duties similar to those of other small businessmen.

A number of pilots are employed by the FAA, primarily to examine applicants for certificates and ratings, and inspect civil aircraft, flying schools, and repair stations. They also patrol and inspect navigation facilities along the Federal airways. The FAA also employs a few pilots to test new flight equipment at experimental stations. Other Federal agencies employ pilots to take wildlife inventories, enforce game laws, spray fields, fight forest fires, or patrol national boundaries.

Qualifications, Training, and Advancement

To do any type of flying, a pilot must be licensed by the FAA. To transport passengers or cargo for pay, he must have a commercial pilot's license, which requires 200 hours of flight experience. Captains employed on scheduled airline flights also need an airline transport rating, which requires 1,200 flight hours, and a rating for instrument flying. In addition, pilots are rated on the type of plane they can fly such as single-engine, multiengine, land, or seaplane.

To qualify for licenses and ratings, an applicant must pass a physical examination and a written test given by the FAA, submit proof of completing the minimum flight-time requirements, and demonstrate flying skill and technical competence. His certification as a pilot remains in effect indefinitely, as long as he can pass an annual physical examination.

A young man may obtain the knowledge, skills, and flight experience necessary to become a pilot through military service or from a private flying school. Graduation from flying schools approved by the FAA satisfies the flight experience requirements for licensing. Appropriate military flight training and experience are accepted in place of the FAA written and practical tests. Those trained in the armed services have the added opportunity to log hours on large aircraft similar to those used by the airlines.

As a rule, applicants for a pilot's job with the airlines must be between 23 and 30 years old, 5 feet 7 inches to 6 feet 4 inches tall, and weigh between 140 and 200 pounds. All applicants must be high school graduates; some airlines require 2 years of college and prefer to hire college graduates. Physical requirements for pilots, especially in scheduled airline employment, are very high. They must have 20/20 vision without the aid of glasses, good hearing, outstanding physical stamina, and no physical handicaps that would prevent quick reactions. Since flying large aircraft places heavy demands upon a pilot, the airlines give psychological tests to determine an applicant's alertness, emotional stability and maturity, and his ability to assume responsibility, command respect, and make quick decisions and accurate judgments under pressure.

Men hired by the scheduled airlines (and by some of the larger nonscheduled airlines) usually start as copilots, although in a few airlines they may begin as flight engineers. An applicant for a copilot's job with a scheduled airline often must have more than the FAA minimum qualifications for licensing. For example, although the applicant can qualify for a commercial license with 200 flying hours, the airlines generally require from 500 to 1,000. Airlines also require a restricted radio-telephone operator's permit issued by the Federal Communications Commission.

All new airlines pilots go through a company orientation course. In addition, some airlines give new copilots from 3 to 10 weeks of training on company planes before assigning them to a scheduled flight. Trainess also receive classroom instruction in subjects such as flight theory, radio operation, Civil Air Regulations, and airline operations.

The new copilot generally is permitted only limited responsibility, such as operating the flight controls in good weather over safe terrain. As he gains experience and skill, his responsibilities gradually are increased. When he has proved his skill, accumulated sufficient seniority, and passed additional tests, a copilot may advance to captain as openings arise. A minimum of 2 or 3 years' service is required; but in actual practice, his advancement often takes at least 5 to 7 years.

There are a few opportunities for airline pilots with administrative ability to advance to chief pilot, flight operations manager, and other supervisory and executive jobs. Most airline captains, however, spend their entire careers flying; and as they increase their seniority, they obtain a better selection of flight routes and schedules which offer higher earnings. Some pilots may go into business for themselves if they have adequate financial resources and business ability, operating their own flying schools or air-taxi and other aerial services. Pilots may also shift to administrative and inspection jobs in aircraft manufacturing and government aviation agencies, even when they are no longer able to fly.

Employment Outlook

A moderate increase in the employment of pilots is expected in the 1960's. This is a relatively small occupation (about 14,000 employed in scheduled airlines in 1958) which will be affected by the use of the larger, faster, and more efficient jet and turboprop aircraft now being introduced. In these planes, a pilot is able to fly many more passenger and cargo miles than he can in piston aircraft. Thus, although the volume of air traffic is expected to continue to grow rapidly in the 1960's, there will probably be little or no need for additional pilots during the next few years. However, after the period of transition to new flight equipment, the continuing large increase in traffic should result in an expansion of airline activity and lead to a slow rise in the demand for pilots.

The employment of pilots outside of the airlines is expected to grow in the next decade. Flying of business executives, crop dusting, and air taxi and patrol work are among the activities expected to increase most rapidly.

Earnings and Working Conditions

Pilots are among the highest paid workers in the Nation. Pilots and copilots employed by the scheduled airlines averaged in 1958 about $13,400 a year in domestic air transportation, and $14,600 in international operations. Some of the senior captains on the large aircraft earned well over $20,000 a year. Those assigned to the new jet aircraft may earn more than $30,000 a year. Pilots employed by the scheduled airlines generally earn more than those employed elsewhere, although pilots in nonscheduled airlines may earn almost as much. Beginning copilots generally earned $4,800 a year. Some experienced copilots in 1958 were earning as much as $10,000 in domestic and more than $12,000 a year in international flying.

The earnings of pilots vary considerably according to factors such as the type, size, and speed of the planes they fly, the number of hours and miles flown, and their length of service. They receive additional pay for night and international flights. Airline copilots with at least 3 years of service and captains are guaranteed minimum monthly earnings which represent a substantial proportion of their normal earnings.

Under Government regulations, pilots cannot fly more than 85 hours a month in domestic operations or over 255 a quarter in international flying. In actual practice, they average between 72 and 82 hours' flying time a month, plus between 15 and 35 hours in ground duties before and after their flights.

Some pilots prefer local airline and business flying to trunk or international airline employment because they are likely to spend less time away from their home bases and fly mostly during the daytime. These pilots, however, have the added strain of making more takeoffs and landings daily.

Although flying does not involve much physical effort, the pilot is often subject to stress because of his great responsibility. He must be constantly alert and prepared to make decisions quickly. Poor weather conditions also make his work more difficult.

Most airline pilots are members of the International Air Line Pilots Association.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Flight Engineers

(D.O.T. 5–80.100)

Nature of Work

A flight engineer assists the captain and copilot on the large commercial airplanes. He is responsible for the proper functioning of the engine and auxiliary equipment, thus permitting the pilots to concentrate on flying the plane. Before takeoffs, he makes certain preflight checks on the condition of the aircraft, determines fuel requirements, and checks the weight and loading of cargo.

In the air, he monitors and operates many instruments and devices to check the performance of the engines and the air-conditioning, pressurizing, and electrical systems. In addition, he keeps records of engine performance and fuel consumption. He reports any mechanical difficulties to the captain and, if possible, makes emergency repairs. Upon landing, he reports any mechanical troubles to lead mechanics who then supervise any necessary ground repairs or maintenance. Flight engineers employed by the smaller airlines may have to make minor repairs at those few stops where no mechanics are stationed.

All 4-engine planes that have a maximum takeoff weight of more than 80,000 pounds must carry a licensed flight engineer. Almost all of the 4,000 flight engineers were working for the major scheduled airlines, which operated virtually all planes of this type. Most flight engineers are stationed in or near large cities where long-distance flights originate and terminate.

Qualifications, Training, and Advancement

All flight engineers must be licensed by the FAA. A man can qualify for a flight engineer certificate if he has had 2 years of training or 3 years of work experience in the maintenance, repair, and overhaul of aircraft and engines, including a minimum of 6 months' training or a year of experience on large 4-engine equipment. He may also qualify with at least 200 hours of flight time as a pilot in command of a 4-engine plane or 100 hours of experience as a flight engineer in the Armed Forces. A third method of qualifying is to complete a course of ground and flight instruction approved by the FAA. In 1958, a few of the airlines conducted such courses for their prospective flight engineers.

In addition to having the experience or training mentioned above, an applicant for a license must pass a written test on flight theory, engine and aircraft performance, fuel requirements, meteorology as it affects engine operation, and maintenance procedures. He must also pass a rigid physical examination and, in a practical flight test on a 4-engine plane, demonstrate his skill in emergency procedures and his ability to discover inflight troubles.

Young men can acquire the knowledge and skills necessary to qualify as airline flight engineers through military training as airplane pilots, mechanics, or flight engineers. They may also attend a civilian ground school and then gain experience as an airplane mechanic. Airlines which employ mechanic-trained flight engineers usually select men from among their own senior mechanics and give them additional training for 5 or 6 months to qualify them for flight duties.

In hiring a licensed flight engineer, airlines generally prefer a man who is 23 to 35 years of age, from 5 feet 7 inches to 6 feet 4 inches tall, and in excellent physical condition. They require a high school education and prefer to hire men with 2 or more years of college. For employment in airlines which hire mechanic-trained flight engineers, applicants must have an FAA mechanic certificate. Some airlines, however, hire pilot-trained flight engineers. In these airlines, the flight engineer is usually the entry job for pilots.

A flight engineer can become a chief flight engineer for his airline. His advancement for the most part, however, comes by gaining enough seniority to give him the right to select the routes and schedules which offer the highest earnings. In airlines that employ pilot-qualified flight engineers, he can be promoted to copilot, and he then follows the line of advancement open to other pilots.

Employment Outlook

The employment of flight engineers is expected to increase slowly during the 1960's. Employment in this small occupation (4,000 in late 1958) will probably remain relatively stable during the early part of the next decade as the faster and more efficient turboprops and jets continue to be put into scheduled airline service. After this transition to the new type of planes, the anticipated growth in air traffic should result in a slow increase in the employment of flight engineers.

Earnings and Working Conditions

In late 1958, the earnings of flight engineers ranged from about $550 a month for new employees up to $1,450 for experienced flight engineers on jet aircraft. Most senior flight engineers earned between $1,000 and $1,350 a month. The average monthly earnings for all flight engineers in domestic operations was $850; those employed on international flights averaged $950 a month. The earnings of flight engineers depend upon such factors as the size and speed of the plane, the hours and miles flown, length of service, and the type of flight (night, international, etc.). Engineers are guaranteed minimum monthly earnings, which represent a substantial proportion of their normal earnings. Actual flight time is restricted, under government regulations, to a maximum of 85 hours a month in domestic flying or 255 hours a quarter in international operations.

Most flight engineers belong to the Flight Engineers' International Association. Some of these workers are represented by the International Association of Machinists.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Stewardesses

(D.O.T. 2-25.37)

Nature of Work

Stewardesses or stewards (sometimes called flight attendants) are aboard almost all passenger flights operated by the commercial airlines. Their major job is to make the passengers' flight as comfortable and enjoyable as possible from the time the passengers board the plane until they arrive at their destinations. Like other flight personnel, they are responsible to the captain.

Before each flight, the stewardess sits in on the briefing of the flight crew. She sees that the passenger cabin is in order, that supplies and emergency passenger gear are aboard, and that necessary food and beverages are in the galley. As the passengers come aboard, she greets them, checks their tickets, and assists them with their coats and small luggage.

During the flight, the stewardess makes certain that seat belts are fastened and gives safety instructions when required. She answers questions about the flight and weather, distributes reading matter and pillows, helps care for small children and babies, and keeps the cabin neat. On first-class flights, she also serves ready-cooked meals. On coach and tourist flights, she may serve light refreshments. On international flights, she also gives customs information, instructs passengers on the use of emergency equipment, and repeats instructions in various languages to accommodate foreign passengers. After the flight, she completes flight reports about the passengers, cabin, and supplies.

In mid-1958, about 9,000 stewardesses and 1,000 stewards worked for the scheduled airlines. About 80 percent were employed by the domestic airlines, and the rest worked for international lines. Most of the stewards were employed on overseas flights where heavier work was involved, such as making up berths. Most airliners carry one to three flight attendants, depending on the size of the plane and whether the flight is tourist or first-class. The new jetliners will probably carry more attendants on each flight. Most flight attendants are stationed in major cities at the airlines' main bases. A few who serve on international flights are based in foreign countries.

Qualifications, Training, and Advancement

Because stewardesses are in constant contact with passengers, the airlines place great stress on hiring young women who are attractive, poised, tactful, and resourceful. As a rule, applicants must be 20 to 27 years old, 5 feet 2 inches to 5 feet 8 inches tall, with weight in proportion to height (but not to exceed 135 pounds), and in excellent

Stewardess serving dinner to passengers aboard airliner.

health. They must also have a pleasant speaking voice, and have good vision. Most major airlines require that stewardesses be unmarried and require them to resign when they marry or shortly afterwards. At least one major airline and some of the smaller ones, however, allow them to remain after marriage. Some companies will hire widows and divorcees without children.

Applicants for stewardess' jobs must have at least a high school education. Those with 2 years of college, nurses' training, or business experience in dealing with the public are preferred. Stewardesses who work for international airlines generally must be able to speak fluently an appropriate foreign language.

Most large airlines give about 5 weeks of training to newly hired stewardesses in their own schools. Girls receive free transportation to the training centers, and also may receive an allowance while in attendance. Training includes classes in air regulations, flight duties, company operations and schedules, emergency procedures and first aid, and personal grooming. Additional courses in passport and customs regulations are given trainees for the international routes. Toward the end of their training, students go on practice flights and perform their duties under actual flight conditions.

(A few airlines which do not operate their own schools employ graduates who have paid for their own training at private stewardess schools. Girls interested in becoming stewardesses should check with the airlines before entering a private school to be sure they have the necessary qualifications for an airline stewardess.)

Immediately upon completing their training, new stewardesses report for work at one of their airline's main bases. They serve on probation for about 6 months, and an experienced stewardess usually works with them on their first flights. Until a regular flight is available, they may work as reserve flight attendants, during which time they serve on extra flights or replace stewardesses who are sick or on vacation.

Stewardesses may advance to jobs as first stewardess or purser, supervising stewardess, stewardess instructor, or recruiting representative. Such jobs are few in number. However, since on the average, stewardesses work only about 2 or 3 years and then resign to get married, advancement opportunities for those who continue to work are good. Stewardesses who can no longer qualify for flying, such as those who marry, may obtain airline ground jobs as traffic or public relations personnel.

Employment Outlook

Employment opportunities for stewardesses will be favorable in the 1960's. Although employment will increase only moderately during the next decade in this relatively small occupation (9,000 in mid-1958), a high turnover rate will result in a substantial number of job openings for new workers. About 40 percent of the employed stewardesses leave their jobs each year. The moderate increase in total employment will result from the anticipated large increase in passenger traffic during the 1960's, which should more than offset any effect that the introduction of the faster jet planes may have on the number of stewardesses employed.

Young women interested in becoming stewardesses should realize that thousands of girls apply for this type of work each year, because of the glamour attached to the occupation. Despite the large number of applicants, the airlines are finding it difficult to obtain enough young women who can meet their high standards of attractiveness, personality, and intelligence.

Earnings and Working Conditions

Beginning stewardesses employed by large domestic airlines generally earned about $280 per month for 85 hours of flying time in late 1958. Stewardesses with 2 years of experience earned about $330 a month. All stewardesses employed on domestic flights averaged $310 a month; those working on international flights averaged about $375 a month.

Since commercial airlines operate around the clock 365 days a year, stewardesses usually work irregular hours. They may work at night, on holidays, and on weekends. They are normally limited to maximum flight time of 85 hours a month. In addition, they devote up to 35 hours a month to ground duties. As a result of irregular hours and limitations on the amount of flying time, some stewardesses may have 15 or more days off each month. Of course, some time off may occur between flights while away from home.

Airlines generally use the seniority bidding system for assigning home bases, flight schedules, and routes. Stewardesses with the longest service, therefore, get the more desirable flights.

The stewardess' occupation is exciting and glamorous, with opportunities to meet interesting passengers and to see new places. However, the work can be strenuous and trying. A stewardess may be on her feet during a large part of the flight. She must remain pleasant and efficient during the entire flight, regardless of how tired she gets.

Most stewardesses belong to unions. Many of them are represented by the International Air Line Stewards and Stewardesses Association. Others are members of the Transport Workers Union of America.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Airplane Mechanics

(D.O.T. 5-80.100, .120 and .130)

Nature of Work

The airplane mechanic is responsible for keeping the airplane in proper working order. Mechanics employed by the airlines are assigned either to line-maintenance or to overhaul work. Line-maintenance mechanics work at the larger airline terminals servicing and inspecting aircraft and making minor repairs and adjustments. When an engine or other piece of equipment is due for major repairs, these mechanics remove it from the plane and install new or overhauled equipment in its place. Line-maintenance shops usually have small staffs; most line-maintenance mechanics must therefore be all-round mechanics able to make repairs on any part of the plane.

Mechanics employed at the airline's main overhaul base make major repairs and do periodic overhaul work on engines and airframes. Since most aircraft maintenance at these bases consists of replacing and reconditioning equipment at fixed intervals rather than repairing equipment that has broken down in service, the operations can be scheduled in advance and work assignments vary little from day to day. With this organization of work, it is feasible to employ mechanics who usually specialize in a particular part of the airplane, such as engines, propellers, hydraulic equipment, electrical equipment, radio and radar, instruments, or sheet metal. The proportion of all-round mechanics at the main overhaul bases is considerably lower than at other airline terminals.

Most airplane mechanics not employed by the airlines do servicing and inspection work roughly comparable with that performed by line-maintenance mechanics. However, the planes which these mechanics service are often much smaller than those flown by the airlines; many of them have only a few instruments and a simple propeller. One mechanic frequently must do the entire servicing job with little supervision, and he must be able to work on many types of planes and engines. Mechanics employed by some of the large flying services, flying schools, and independent repair shops may also do overhaul work. Independent shops usually specialize in either airframe, engine, or instrument overhaul.

Mechanic making repairs on an aircraft engine.

The FAA requies that all repair and overhaul work must be performed, supervised, or inspected by an FAA approved mechanic, experienced in the type of work performed. The FAA-approved mechanic must certify that the plane is fit for service.

Approximately 31,000 mechanics were employed by the scheduled airlines in late 1958. Many other mechanics were employed by the nonscheduled airlines, independent aircraft and engine repair firms, and by firms that operate flying schools and do aerial photography, advertising (sky writing), and agricultural work such as dusting, spraying, and seeding. Many airplane mechanics work in aircraft manufacturing plants. (These workers, whose duties are somewhat different from those of airline mechanics, are discussed in detail in the chapter on Aircraft Manufacturing Occupations. See index for page numbers.)

About 25,000 civilian airplane mechanics were employed by the Air Force in late 1958. Another 10,000 worked for the Navy. The FAA employs a small number of experienced maintenance personnel to inspect aircraft manufacturing plants, in addition to employing air carrier maintenance inspectors who examine airline maintenance methods, training programs, and spare parts in stock, and inspect commercial aircraft. This agency also employs a few airplane mechanics to maintain its own planes. Some mechanics are employed by other government agencies, principally in the National Aeronautics and Space Administration.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main overhaul base where more than half of its mechanics are employed. Cities such as New York, Chicago, Los Angeles, San Francisco, and Miami, all of which are important domestic and international air traffic centers, have large concentrations of mechanics.

Qualifications, Training, and Advancement

Because the safety of an aircraft in flight depends largely on good mechanical operation, the FAA requires those mechanics who are responsible for any repair or maintenance work to be licensed. Mechanics may be licensed as qualified to repair either airframes (A) or powerplants (P) or both (A and P). Mechanics who also repair instruments must have an additional repairman certificate. Those who work on radio and radar equipment are required to have an FCC radiotelephone license.

To obtain an A or P license, a man must have at least 18 months' experience working with airframes or engines; for the combined A and P license, he must have worked at least 30 months with both engines and airframes. This experience is not required of graduates of mechanics' schools approved by the FAA. In addition to meeting these requirements, all mechanics must pass a written test and give a practical demonstration of their ability to do the work.

Most mechanics prepare for the trade by working as trainees, apprentices, or helpers. The larger airlines train apprentices or trainees in a carefully planned 3- or 4-year program of instruction and work experience. Men who have learned aircraft maintenance in the Armed Forces are usually given credit for this training toward the requirements of apprenticeship or other on-the-job training programs.

For apprentices or trainee jobs, the airlines prefer men between the ages of 20 or 30 who are in good physical condition. Applicants should have a high school or trade school education, including courses in mathematics, physics, chemistry, and machine shop. Experience in automotive repairs or other mechanical work is also helpful.

Apprentices are often required to own a considerable number of handtools, which they must pay for themselves.

Some airplane mechanics learn their trade by working as helpers to experienced mechanics and thus acquire enough knowledge and skill to pass the FAA examinations to become licensed mechanics. Those who already have a license may be able to start as journeymen mechanics.

Many other mechanics prepare for their trade by graduating from an FAA approved mechanics' school. Most of these schools have an 18- to 24-month program. Several colleges and universities also offer 2-year programs that prepare the student for the FAA mechanic examinations and for jobs as engineering aids and research and development technicians in aircraft manufacturing.

Journeymen mechanics in the scheduled airlines may advance to a number of higher positions. The line of advancement is usually mechanic, lead mechanic (or crew chief), inspector, lead inspector, shop foreman, and, in a few cases, supervisory and executive positions. In most shops, mechanics in the higher grade positions are required to have both airframe and powerplant ratings. In many cases, the mechanic must pass a company examination before he is promoted. A mechanic may also become a flight engineer after satisfying the FAA and airline requirements.

For jobs as air carrier maintenance inspectors for the FAA, mechanics must have broad experience in maintenance and overhaul work, including supervision over the maintenance of large transport aircraft. Applicants for this job must also have an A and P rating.

Employment Outlook

A moderate increase in the employment of airplane mechanics is expected during the 1960's. During the early part of the decade, the number of mechanics employed by scheduled airlines is expected to remain relatively stable. During the period of transition from piston engines to turboprop and pure jets, there will be relatively few employment opportunities for mechanics. Since these new planes have larger capacities and greater speeds than piston planes, the airline fleet will probably grow only slightly in the early years of the decade. Furthermore, the simpler engines in the jet aircraft may reduce somewhat the amount of maintenance required. An increase in the employment of airline mechanics, however, is expected in the latter part of the 1960's as a result of the continued large expansion of air traffic.

The rapid growth anticipated in the amount of business flying and a moderate expansion of other flying services will also contribute to an increase in the number of mechanics employed in this field of work. The number of mechanics employed outside of the scheduled airlines has been increasing rapidly. The FAA reports that the number of approved repair stations, which do most of the maintenance and repair work on nonairline planes, increased from 376 in 1955 to 532 at the beginning of 1959. The anticipated increase in business executive and commercial flying will require many additional planes and more mechanics.

Employment opportunities for airplane mechanics in the Federal Government will depend largely on the size of the Government's military aircraft program.

Earnings and Working Conditions

The average weekly earnings of mechanics employed by domestic scheduled airlines was about $110 in 1958. Other airplane mechanics generally have lower average earnings.

Airline mechanics work in hangers or in other indoor areas, whenever possible. However, when repairs must be made quickly, as is sometimes the case in line-maintenance work, mechanics have to work outdoors.

Mechanics are covered by union agreements on most major airlines. Most of these employees are members of the International Association of Machinists. Many others belong to the Transport Workers Union of America.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Traffic Agents and Clerks

(D.O.T. 1–44.12, .27, and .32)

Nature of Work

About 25,000 persons were employed in late 1958 by the scheduled airlines as ticket or reservation agents, operations or station agents, freight or cargo agents, and traffic representatives.

Reservation agents and clerks give customers schedule and fare information over the telephone. They record, report, and post reservations as they are made and process teletype messages regarding space available on aircraft. Ticket agents sell tickets to passengers at downtown offices or at the airport ticket counters as passengers check in for their flights. They also check baggage at the airport, answer inquiries about flight schedules and fares, and keep records of tickets sold. Traffic representatives contact potential customers in order to promote greater use of the airlines' services.

Operations or station agents are responsible for the ground handling of airplanes at their stations. They supervise the loading and unloading of the aircraft and sometimes do this work themselves. They see that the weight carried by the planes is distributed properly, compute gas loads, prepare cargo and weight manifests, and keep records of the number of passengers and amount of cargo carried. They may also fill out weather forms and make arrival and departure announcements.

Traffic staffs are located principally in downtown offices and at airports in or near large cities where most airline passenger and cargo business originates. Some are employed in smaller communities where airlines have scheduled stops.

Qualifications, Training, and Advancement

Traffic agents and clerks must deal directly with the public, either in person or by telephone. For this reason, airlines have strict hiring standards with respect to appearance, personality, and education. A good speaking voice is essential because of the frequent use of the telephone or public address systems. High school graduation generally is required, and college training is considered desirable. Experience with freight, passenger, or express traffic in other branches of transportation is also valuable.

College courses in air transportation, such as traffic and fare analysis and aviation management, as well as experience in other areas of air transportation are helpful for higher grade jobs. Both men and women are employed as reservation and ticket agents; however, operations agents generally are men.

Traffic agents may advance to positions as traffic representatives and supervisors. A few may eventually move up to city and district traffic and station managers. Some are able, with their traffic experience, to transfer to better paying jobs with travel agencies or to the traffic departments of big corporations.

Employment Outlook

Although total employment in traffic jobs is expected to increase only slightly during the 1960's, the high turnover rate among reservation and ticket agents will provide many job opportunities each year for new workers. Despite the anticipated large expansion of air traffic expected in the 1960–70 decade, the increased use of electronic equipment for processing information, such as reservations, will enable the airlines to handle the greater volume of business with only a slight increase in traffic personnel.

Most of the major airlines are installing new machines to record and process reservations, keep records, and perform a variety of other routine tasks. The job of reservation clerk, in particular, will be affected by this mechanization. The employment of ticket agents, however, whose main job involves personal contacts, will not be affected very much, although their paper work will be reduced considerably. In addition, improved equipment for the handling of baggage and freight will tend to reduce the need for workers doing these jobs. The small group of traffic representatives will probably increase substantially as the airlines compete for new business.

Earnings and Working Conditions

Beginning salaries of reservations and ticket agents ranged from $235 to $320 a month in late

1958. Station and operations agents started at $250 to $340 a month. Experienced reservation and ticket agents earned up to $400 a month; the top earnings of experienced station and operations agents were about $450 a month.

Many reservation and transportation agents belong to unions. Most of the organized agents belong to the Transport Workers Union of America or the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes. The Air Line Agents Association also represents some of these workers.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Airline Dispatchers

(D.O.T. 0–61.61)

Nature of Work

Dispatchers are employed by the airlines to coordinate flight schedules and operations within an assigned area and to see that all FAA and company flight and safety regulations are observed. Stationed mostly at airline dispatch centers at major air terminals, they review flight plans with the pilots and give them airline authority to make a flight. Frequently, they participate in the flight planning for overseas flights and, occasionally, for some domestic operations.

Before the flight begins, the dispatcher analyzes meteorological data to advise the captain about flight weather conditions. After the flight has begun, he plots progress, as reported by the pilots at regular intervals by radio, and keeps the captain informed of changing weather and other conditions affecting his flight. He also gives airline clearances for alternate landings when ground or weather conditions do not permit a pilot to land at a scheduled airport.

Dispatchers may also notify crew members when to report for duty before a flight and arrange for substitutes when necessary. In some instances, they also are responsible for keeping records and checking such matters as the availability of aircraft and equipment, the weight and balance of loaded cargo, the amount of time logged by each plane and engine, and the number of hours flown by each crew member based at their stations. Assistant dispatchers aid in this work by helping to plot the progress of flights, securing weather information, and handling communications with the aircraft.

In 1958, only about 700 dispatchers and 200 assistants were employed in scheduled domestic and international operations, primarily at large airports in the United States. A small number work for the large nonscheduled airlines and for private firms which offer dispatching services to small airlines.

Qualifications, Training, and Advancement

Dispatchers are required to have an FAA dispatcher certificate. An applicant may qualify in part for certification if he has spent at least a year engaged in dispatching work under the supervision of a certified dispatcher. He may also qualify by completing an FAA-approved dispatcher's course at a school or an airline training center. If an applicant has none of this schooling or experience, he may also qualify if he has spent 2 of the previous 3 years in air traffic control work, or in such airline jobs as dispatch clerk or radio operator, or in similar work in military service.

An applicant for an FAA dispatcher certificate must also pass a written examination on such subjects as Civil Air Regulations, weather analysis, air-navigation facilities, radio principles, and airport and airway traffic procedures. In an oral test, he also has to demonstrate his ability to interpret weather information, his knowledge of aircraft operational characteristics, and his familiarity with airline route structures and navigational facilities. A licensed dispatcher is checked periodically to satisfy the FAA that he is maintaining his dispatching skills. Each year, he is also required to "fly the line" as an observer over the portion of the system which he services in order to maintain his first-hand familiarity with the airline routes and flight operations.

For assistant dispatcher jobs, airlines generally hire men who have had at least 2 years

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of college. College graduates who have had courses in mathematics, physics, and related subjects are preferred. Some experience in flying, meteorology, or business administration is also helpful. Although an assistant dispatcher is not required to have an FAA dispatcher certificate, some airlines will pay assistants higher salaries if they are certificated.

Most airlines fill dispatcher positions by promotion or transfer from within the company. Men are preferred who have had long experience in ground flight operations work. As a result, many openings are filled by men who have been assistant dispatchers or meteorologists, and a few jobs are filled by men who have had flight experience as pilots.

Employment Outlook

The increase in airline traffic anticipated in the 1960's is expected to result in a slight increase in the number of workers employed in this small occupation (700 in 1958). Most new workers will be hired as assistant dispatchers. The bulk of the job openings for dispatchers will be filled by promoting or transferring persons already employed by the airlines.

As communication facilities continue to improve, a dispatcher at a major terminal center will be able to service larger areas by dispatching aircraft at the smaller airports by radio and telephone. The effect of this trend on employment, however, will be more than offset by the need for additional personnel resulting from the increase in air traffic, the addition and extension of airline routes, and the added difficulties in dispatching jet aircraft. As a result, an overall rise in the employment of dispatchers can be expected during the 1960's.

Earnings and Working Conditions

In early 1959, basic salaries for most dispatchers ranged from a beginning rate of $575 to about $950 a month after 10 years of service. Assistant dispatchers earned about $400 to start and $550 a month after 5 years. Assistants with FAA certificates may earn an additional $25 a month. Most dispatchers are members of the Air Line Dispatchers Association.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Air Traffic Controllers

Nature of Work

Air traffic, both in the immediate vicinity of airports and between airports, must be regulated to assure safe and orderly flights from points of departure to destination. The men who supervise the traffic in the area around an airport are known as *airport traffic controllers* (D.O.T. 0–61.60); the men who guide planes being flown between airports are called *air-route traffic controllers*. The weather, the geography, the amount of traffic, and the size, speed, and other operating characteristics of aircraft are some of the factors which these men must take into consideration when directing traffic.

Airport traffic controllers are stationed at Federal Aviation Agency airport control towers to give pilots, within a radius of about 20 miles, takeoff and landing instructions concerning flight approaches, the use of airfield runways, altitudes, and time schedules. They give these instructions, as well as weather and position information, to pilots by means of radio. These workers keep records of all messages received from aircraft and operate runway lights, radar screens, and other airfield equipment. They may also send and receive information to and from air-route traffic control centers about every flight made over the airport.

Air-route traffic controllers are stationed at FAA control centers. They use written flight plans to coordinate the movements of planes which are being flown "on instruments" between airports. To assure that planes remain on course, they check the progress of flights by radar and other electronic equipment and by information received from the aircraft, other control centers and towers, and FAA or airline communication stations. They then determine whether planes can enter their control area.

In early 1959, more than 12,000 air traffic controllers were employed by the FAA, an agency of the Federal Government. About 5,000 airport traffic controllers were employed at airport control towers located at airfields with heavy traffic, most of which are near big cities. A few of these jobs are located at a small number of towers outside the continental United States. About 7,000 air-route traffic controllers worked at control centers scattered along the airways throughout the United States.

Qualifications, Training, and Advancement

An applicant for a position as an FAA traffic controller must be at least 18 years old and able to speak clearly and precisely. He enters through the competitive Civil Service system after passing a physical examination. He must have had from 2 to 3 years of experience in one or a combination of several fields, such as flight communications, radar operations, dispatching, and flying. Education beyond high school may be partially substituted for some of this experience; however, some experience in air-ground communications is considered necessary.

Successful applicants are given 6 weeks of formal training at a central FAA school to learn the fundamentals of air traffic control. After completing this training, they qualify for a basic air traffic control certificate. They are then assigned to an FAA control tower or center for additional classroom instruction and receive on-the-job training to become familiar with the specific traffic problems around their bases. After 6 months, they normally qualify as assistant controllers, and after another year, they are eligible for jobs as senior controllers.

Senior controllers can advance to chief controllers. After they reach this level, they may advance to more responsible management jobs in air traffic control. A few top administrative jobs in the FAA also offer avenues for promotion.

Employment Outlook

Approximately 2,000 air traffic controllers will be needed each year in the 1960's as a result of the anticipated expansion in air traffic. The big increase in the number of aircraft during the past few years has already made the airways congested, placing a tremendous burden on air traffic control facilities. Because of this rapid expansion, there is currently a shortage of well-qualified applicants to meet the demand for additional traffic controllers. For example, the FAA estimated there was a need for about 4,000 new controllers in 1959.

The shortage is expected to continue as even more planes use the airways. Furthermore, the larger and faster turboprop and jet airlines will require better control facilities to insure the greatest degree of safety. As a result, unlike most of the airline occupations, employment of air traffic control specialists will increase considerably during the early 1960's.

Earnings and Working Conditions

In 1959, the starting salary for a newly hired FAA controller was about $375 a month during his first 6 months of formal training. After this period, he generally receives $4,980 or $5,470 during his first year as an assistant traffic controller, depending upon the type and size of the base where he is employed. Senior controllers in both airport and air-route work may earn $7,030 or $9,890 a year, also depending on the amount of traffic handled by their control unit. In addition, they receive automatic increases every 12 or 18 months, depending upon the grade held. In the areas that handle extremely high volumes of air traffic, it is possible for a chief controller to earn more than $11,000 a year. These employees receive the same annual and sick leave and other benefits as other Federal workers.

FAA controllers have a basic 40-hour week; however, they often work overtime, which is compensated for by equivalent time off or additional pay. Control towers and centers must be manned 24 hours a day, and controllers are periodically assigned to night shifts on a rotating basis.

Because of the congestion in air traffic, a controller works under great stress. He must, at one time, check flights already under his control, know the schedules of those that are approaching his area, and coordinate these patterns with other controllers as each flight passes from his control area to another.

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

Ground Radio Operators and Teletypists

(D.O.T. 0–61.33 and 1–37.33)

Nature of Work

Airline radio operators relay messages between ground stations and between flight and ground personnel. They use radiotelephone and radiotelegraph to send and receive messages. They occasionally make minor repairs on the equipment they operate. Teletypists also transmit airline communications, but only between ground stations. They operate a teletype machine which has a keyboard similar to that of a typewriter. The FAA also employs aircraft communicators who perform work similar to that of airline employees. These workers collect and relay messages on weather conditions and other flight information between aircraft and FAA control towers, traffic centers, or other FAA radio stations. Some airline and FAA communicators use both radio and teletype in their work.

In early 1959, more than 7,000 ground radio operators and teletypists were employed in air transportation communications. About 2,900 worked for the scheduled airlines, and more than 300 were employed by an industry cooperative which offers the airlines, private pilots, and corporation aircraft its services over a centralized communications system. The largest employer, however, is the FAA, which employed about 4,000 workers in its communications stations in early 1959. The air branches of the Army and Navy employed a few hundred civilians in similar jobs.

Ground radio operators and teletypists employed by the airlines work mostly at airports in or near large cities. FAA operators work at communications stations scattered along the major airline routes, which are sometimes located in remote places.

Qualifications, Training, and Advancement

Applicants for airline radio operator jobs must usually have at least a third-class FCC radiotelephone or radiotelegraph operator's permit, a high school education, a good speaking voice, the ability to type at least 40 words a minute, and a basic knowledge of weather reports. Teletypists must also be able to type 40 words a minute and have had training or experience in operating teletype equipment. Applicants for jobs as radio operators and teletypists must also have a knowledge of standard codes and symbols used in communications.

To qualify for entry positions as FAA communicators, applicants must have had from 2 to 3 years of experience in some phase of air communications, traffic control, or flying. Permanent appointments are made on the basis of civil service examinations.

The airlines usually employ women as teletypists, and an increasing number are being hired as radio operators. FAA communicators, however, are men. Both airline and FAA communicators serve probationary periods, during which time they receive on-the-job training. Skill gained in communications is helpful experience for transferring into higher paying jobs as airline dispatchers or FAA traffic controllers.

Employment Outlook

Although air traffic is expected to rise considerably during the 1960's, only a small increase in the total employment of ground radio operators and teletypists is expected in the next few years. Several hundred openings, nevertheless, will occur each year as a result of transfers to other fields of work, retirements, and deaths.

The number of workers employed in these jobs by the airlines is expected to show a decrease as communications systems become more automatic and centralized. Furthermore, the increasing number of aircraft equipped with radios which allow direct communication between pilots and traffic controllers will also adversely affect the number of radio operators employed by the airlines.

On the other hand, a substantial increase is anticipated in the number of these workers employed by the FAA as it expands its control facilities to handle increased air traffic. This increase is expected to more than offset the decrease in airline communication employment.

Earnings and Working Conditions

Beginning salaries for airline radio operators who held the minimum third-class permit generally were between $260 and $310 a month in late 1958. Workers who held a second-class license generally received $10 or $15 more a month. After 4 or 5 years of service, radio operators could earn up to about $450 a month. Earnings of teletypists generally ranged between $250 and $385 a month in late 1958. Beginning FAA communicators earned about $335 a month; experienced communicators earned up to $615 a month.

Radio operators and teletypists in a number of airlines are unionized. The major union in these fields is the Airline Communications Employees Association (Ind.).

(See introductory section for Where To Go for More Information and for general information on supplementary benefits and working conditions.)

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

Young persons interested in working in a field which has an exciting future would do well to consider the employment opportunities developing in atomic energy—one of science's expanding frontiers. In 1958, more than 175,000 workers were employed in a variety of atomic energy activities. Among these workers were many highly trained persons—scientists, engineers, technicians, and craftsmen. A large proportion of these workers were employed in research and development activities, while others were engaged in the manufacture of uranium fuel, nuclear reactors, and the many kinds of instruments used in the atomic energy field.

Atomic energy is a tremendous source of power for both peaceful and military application. Atomic reactors are already used for the production of electricity. Other reactors are propelling submarines and, in years to come, may be driving surface ships, aircraft, and space satellites. Atomic energy is also used in numerous other ways by industry, medicine, and agriculture. It is a research tool of incalculable value. The many and growing applications of atomic energy make it an important field of employment opportunities.

How Atomic Energy Is Produced

Atomic energy, for which scientists are continually seeking new applications, may be produced through two processes called fission and fusion. In fission, atoms of elements, such as uranium and plutonium, are split. In fusion, atoms of light elements, such as hydrogen, are combined. Tremendous amounts of energy are created by these processes. Atomic bombs are an application of a deliberately uncontrolled and explosive release of energy through the use of the fission and fusion processes. Nonweapon applications of these processes require that release of the tremendous amounts of energy be controlled carefully. Scientists have developed practical methods of controlling the fission reaction, but have not yet mastered control of the fusion reaction.

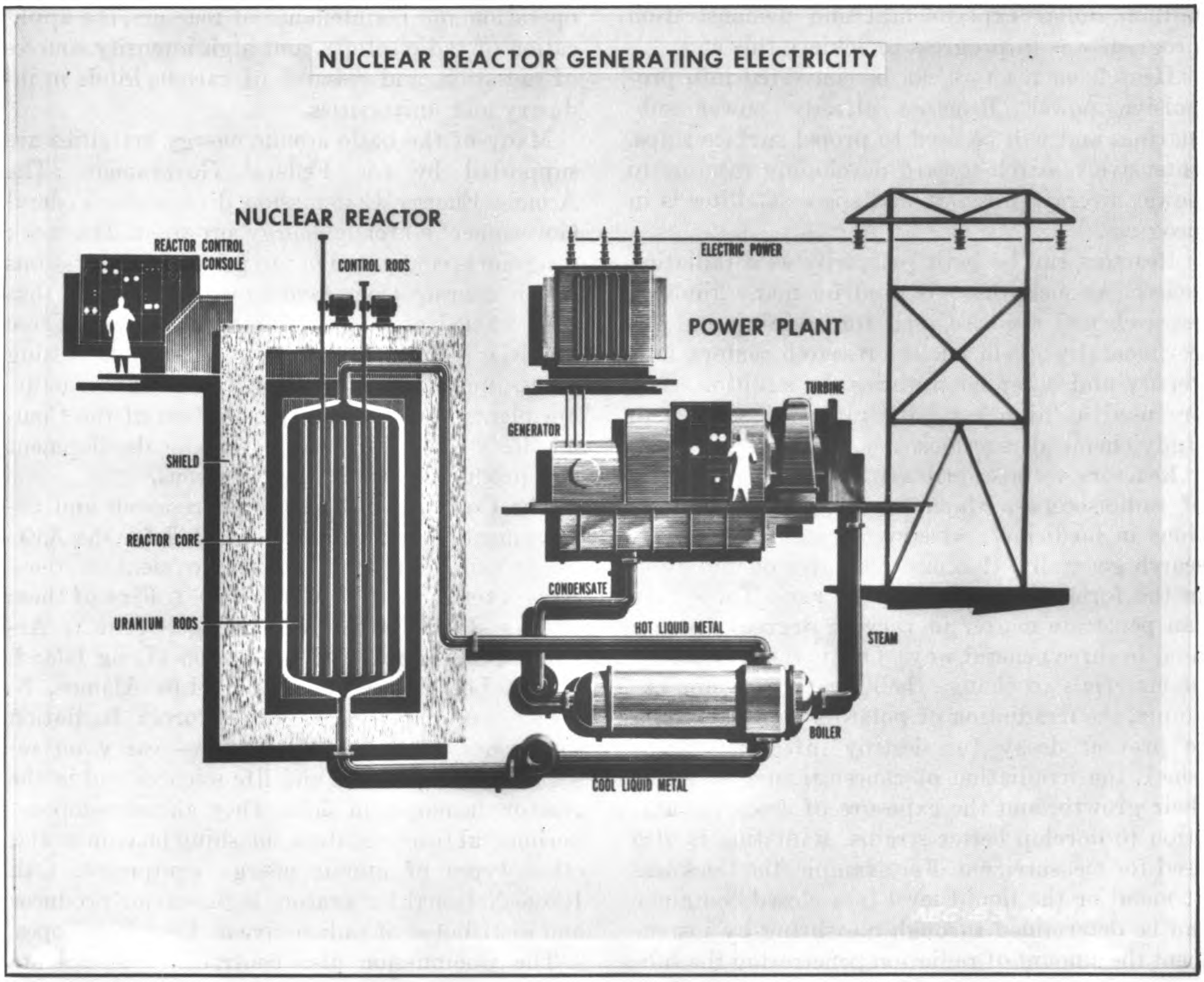
Controlled fission is produced in a nuclear reactor which can be thought of as an atomic furnace. (See chart 33.) A specific mass of fissionable fuel, such as uranium, is placed in a particular arrangement with certain other elements in a heavy metal vessel. The mass of fuel is sufficient to sustain what is called a chain reaction. This reaction in a nuclear furnace results in a continuous and controlled fissioning (or splitting) of uranium atoms and produces a large quantity of energy in the form of heat and radiation. The level of the reaction may be directly controlled by rods of special metals like cadmium, boron, and hafnium which are inserted into the fuel chamber, or "pile" as it is often called, to regulate or stop the reaction.

Both atomic fusion and fission take place in nature. Fusion is generally believed to be the source of the energy of the sun. Atomic fission takes place close to the earth through the interaction of cosmic rays. This is part of what is known as natural background radiation. Prior to the Atomic Age, X-rays were the most commonly known form of radiation. Radiation that arises during fission is called nuclear radiation because it comes from the nucleus of the atom. Nuclear radiation can penetrate matter. It is invisible and, therefore, usually identifiable only by sensitive recording instruments. This type of radiation is dangerous to man. For that reason, the nuclear furnace is housed in a special container and surrounded by sufficient thickness of shielding materials, such as concrete and lead, so that the nuclear radiation is absorbed.

The uranium atoms used as fuel in nuclear reactors give off radiation in the form of neutrons, one of the major particles inside the atomic nucleus. These free neutrons smash into the nuclei (or centers) of other uranium atoms and break them in two. The process of splitting releases energy and several kinds of nuclear radiation. Radioactive atoms of other kinds of elements, such as barium, cesium, and iodine, are derived from the splitting process. The newly formed atoms are called radioactive because they give off nuclear radiation. They are also called radioisotopes. Radioisotopes created during the fission process can be extracted from the fuel core of the reactor by chemical processes. Hundreds of different radioisotopes can also be made by exposing stable atoms to neutrons emanating from the reactor core (or furnace).

Thus, harnessed atomic energy is produced in a nuclear reactor in the form of heat and radiation. The reactor, like other kinds of furnaces, needs fuel to operate. Reactors are fueled principally with two kinds of uranium. The first is called natural uranium. It contains a small quantity (0.7 of 1 percent) of the fissionable isotope, uranium U–235. The remaining atoms are mostly uranium U–238. When the U–235 atoms split, they release "atomic bullets" called neutrons which can be made to split other U–235 atoms. These in turn release additional neutrons which can similarly split more atoms. This is how the fission process or "chain reaction" is started and maintained. One result of this type of reaction is the absorption of neutrons by U–238 which later becomes plutonium, a manmade fissionable and radioactive element whose chief use so far is in weapons. However, a more powerful and efficient type of reactor fuel than natural uranium can be made by separating the U–235 atoms from the U–238 atoms and concentrating the former in metal or solution for reactor fuel. This is the fuel referred to as "enriched uranium." Another re-

CHART 33



actor fuel is obtained by converting the metal thorium into a fissionable material, U–233, by neutron absorption.

Applications of Atomic Energy

The heat and radiation produced in reactors can be used in a number of ways. The major nonweapon uses appear to be the production of electricity, the propulsion of ships and submarines, the heating of buildings, many applications in medicine and agriculture, as a research tool, and as a means of product control in industry. Perhaps the greatest single nonweapon use of atomic energy will be the use of heat from reactors for production of electricity. Economic production of electricity from nuclear power plants had not been achieved by the end of 1958, but a vast multimillion dollar experimental and demonstration program was in progress to achieve this end.

Heat from reactors can be converted into propulsive power. Reactors already power submarines and will be used to propel surface ships. Intensive research toward developing reactors to power aircraft, missiles, and space satellites is in progress.

Reactors can be built primarily as a radiation source. As such, they are used for many kinds of research and are also used for training and experimental work in nuclear research centers, university and other laboratories. In addition, they are used as high intensity radiation sources to study chemical reactions.

Reactors are also utilized for the manufacture of radioisotopes, which have extensive applications in medicine, industry, agriculture, and research generally. Radioisotopes give off radiation in the form of several types of rays. These rays can penetrate matter in varying degrees and are used in three general ways. One is the irradiation of materials to change their properties—for example, the irradiation of potatoes and other food to prevent decay (or destroy infecting organisms), the irradiation of cancer tissues to arrest their growth, and the exposure of seeds to radiation to develop better strains. Radiation is also used for measurement. For example, the thickness of metal or the liquid level in a closed container can be determined through measuring by instrument the amount of radiation penetrating the substance. Industry uses this method in product quality control. Lastly, the rays from radioisotopes can be used as tracers. Radioisotopes can be placed in the blood stream of men and animals, for examples, and their movements traced by instruments recording the emitted rays. In medicine, this may permit the physician to diagnose a patient's illness. Tracing is the most important use of radioisotopes to date and is used widely in medicine, agriculture, and industry.

Nature of the Atomic Energy Field

Many different activities are required for the production and application of nuclear energy. These include the mining and milling of ores, the refining of ore into metal, the manufacture of nuclear fuels (uranium U–235 and plutonium), the manufacture of reactors and components, the operation and maintenance of reactors, the application of radioisotopes and high intensity sources of radiation, and research of various kinds in industry and universities.

Many of the basic atomic energy activities are supported by the Federal Government. The Atomic Energy Commission directs the Federal Government's atomic energy program. The work program is contracted out to private organizations which operate Commission-owned facilities that were valued at almost $7 billion in 1958. These facilities include laboratories, uranium processing plants, nuclear reactors, and weapon manufacturing plants. A substantial proportion of the Commission's expenditures are for the development and production of military weapons.

The Commission owns many research and development centers that are operated for the AEC by private organizations. Employment in these centers totaled about 36,000 in 1958. Five of these centers—Oak Ridge (Oak Ridge, Tenn.), Argonne (Chicago, Ill.), Brookhaven (Long Island, N.Y.), Los Alamos Scientific (Los Alamos, N. Mex.), and University of California Radiation (Livermore, Calif.) Laboratories—carry on research in the physical and life sciences and in the reactor development field. They also develop experimental reactors, atom-smashing machines, and other types of atomic energy equipment. Oak Ridge National Laboratory is the major producer and distributor of radioactive and stable isotopes.

The Commission also contracts with private companies and research laboratories for additional research in geology, medicine, biology, metallurgy, reactor development, waste disposal, reactor component manufacture, etc. In addition, the AEC supports extensive basic scientific research in universities.

Of course, much independent research in atomic energy is carried on without financial assistance from the Commission. Furthermore, the Commission encourages private participation in the atomic energy field by making available, to the fullest extent possible, scientific data on atomic energy, Government-owned facilities for running experiments, and equipment for scientific projects. It also provides financial help to private organizations for the construction and operation of research and power reactors, atom-smashing machines, and other atomic energy facilities, and makes available the necessary fuel.

Private concerns in their own installations are engaged in every type of atomic energy activity except development and production of military weapons and certain nuclear fuel processing operations. Many of these activities, such as ore mining and milling, refining of metals, manufacture of heat transfer equipment and instruments, and construction of facilities, differ little from nonatomic energy operations of the same sort. Other activities, such as manufacture of the fuels needed to run reactors, are unique to the atomic energy field.

Private concerns also produce many materials for use in atomic energy equipment. These materials, depending upon their function, must be able to stand heat, corrosion, or radiation, and must have special properties, such as the ability to slow down neutrons, absorb them, or be impervious to them. Many companies are also engaged in the development and design of reactors. Reactor manufacturers may make the reactor core, which contains the nuclear fuel and other elements, as well as the control rods or other integral pieces of the reactor, but much of the work is subcontracted to companies specializing in the manufacture of such items as steel vessels, heat transfer equipment, pumps and valves, instruments and controls, and shielding materials. Another group of companies specializes in designing and engineering building facilities for nuclear reactors and their auxiliary equipment, atomic energy research laboratories, and nuclear fuel processing plants.

Atomic energy activities are found throughout the United States. These activities are in progress in every State through a university, a hospital, a manufacturer, a mine, or a Commission-owned installation.

Occupations in the Atomic Energy Field

Employment in the atomic energy field is increasing substantially as a result of the growth of present and the development of new applications of atomic energy. Most workers in this field make products or provide services that have only recently been developed. Some of these workers may receive short assignments in foreign countries to assist projects which are being aided by the United States under its international program for the development of peaceful applications of atomic energy.

A relatively high proportion of the more than 175,000 workers in the atomic energy field in 1958 were scientists, engineers, technicians, and skilled craftsmen. This high proportion of technical and professional workers is a result of the large amount of research and development and pilot work now being conducted in this field. However, in some of the activities, such as mining, the occupational distribution is similar to that of comparable nonatomic work. The following is a brief description of the types of workers employed in some of the important atomic energy activities.

Uranium Mining. The almost 6,000 workers employed in uranium mining in 1958 had jobs similar to those in mining of other metal ores. Their jobs were largely concentrated in the Colorado Plateau area of the Far West, in the States of Colorado, Utah, New Mexico, Arizona, and Wyoming. About 7 percent of the employees in uranium mining were in professional and technical jobs. Mining engineers and geologists were the chief professional employees. Among operating employees, the largest groups were miners in underground mines, and truckdrivers, bulldozer operators, and machine loaders in open pit mines.

Uranium Ore Milling. The method of milling uranium ore is similar to that used in milling other types of metallic ores. In milling, metallurgical and chemical processes are used to extract uranium from the mined ore. Mills were generally located on the Colorado Plateau. Uranium ore milling employment was estimated at more than 3,000 in 1958.

About 12 percent of the workers in uranium mills were professional and technical employees. Professional and technical employees included chemists; metallurgical, mechanical, and electrical engineers; laboratory technicians; and engineering aids. Maintenance work required pipefitters, welders, electricians, carpenters, and machinists.

Uranium Refining. In uranium refining plants, the milled uranium is chemically processed to remove impurities and then converted to a metal or other chemical compound. About 4,000 workers were employed by uranium refining plants in 1958.

Managerial, supervisory, and professional workers accounted for about 18 percent of all employees in uranium refining. Chemical engineers and chemists were employed in substantial numbers. Processing operations accounted for the largest proportion of employment. Chemical operators made up the largest individual processing occupation. Machine tool operators who cut uranium metal to shape and skilled maintenance workers, such as pipefitters, instrument repairmen, electricians, and millwrights, were employed in fairly large numbers.

Enrichment of Uranium. Uranium enriched in varying degrees with U–235 atoms is produced in huge plants that separate the fissionable U–235 atoms from the nonfissionable U–238 atoms by the process known as gaseous diffusion. Almost 10,000 workers were employed in these plants in 1958.

Employment in uranium enriching plants was distributed among major occupational groups in the following proportions:

	Percent
Total employment	100
Managerial, supervisory, and professional	20
Clerical and office	18
Maintenance	30
Processing	20
Other workers	12

Maintenance in these chemical plants accounted for 30 percent of the total employment. Important maintenance occupations were maintenance mechanics, instrument mechanics, electricians, pipefitters, millwrights, and rigger-ironworkers. Chemical operators in processing operations comprised the largest single occupation.

Chemical engineers and chemists comprised the largest occupations among professional employers. Substantial numbers of electrical and mechanical engineers, physicists, and mathematicians were also employed.

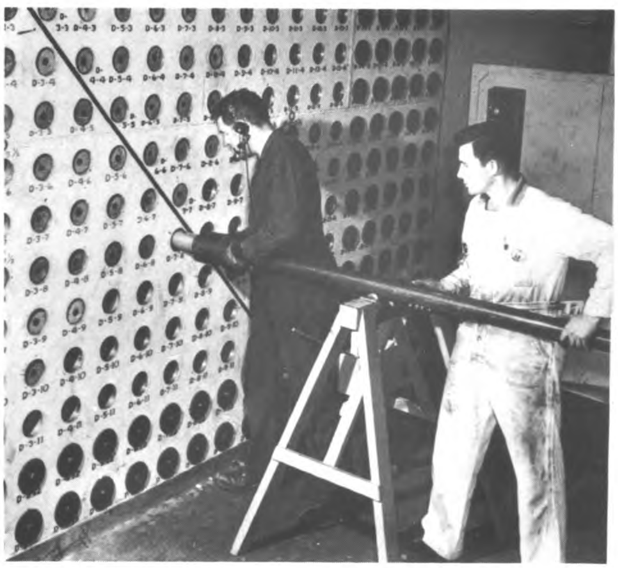
Reactor Manufacturing. More than 15,000 workers were employed by reactor manufacturers in 1958. Reactor manufacturers carry out extensive research and development work on reactors and auxiliary equipment. They design the reactor and may manufacture parts, such as fuel elements, control rods, and reactor cores. More than 30 percent of the employees in firms producing reactors are professional, scientific, and managerial workers. Engineers alone accounted for about 20 percent of employment in 1958. Thirty-five percent of these engineers were mechanical engineers; 17 percent electrical engineers; and chemical, metallurgical, and nuclear reactor engineers each accounted for 10 percent of the total. Physicists comprised the largest group among scientific personnel. Mathematicians, chemists, health physicists, draftsmen, and electronic and mechanical technicians were also employed in sizable numbers.

There were many skilled craftsmen employed in both experimental and production work in reactor manufacturing. Major occupations in production jobs were machine tool operators, machinists, welders, and instrument makers. In firms manufacturing reactor components, which were very similar to standard power equipment, production workers accounted for a much larger proportion of total employment than they did in plants manufacturing reactor parts unique to this field.

Aside from the workers employed by reactor manufacturers in 1958, there were additional workers employed by manufacturers of particle accelerators (often referred to as "atom smashers"). An accelerator is used to study the structure and properties of particles smaller than the atom. With these machines, scientists have obtained a better understanding of the elementary particles which form the nucleus of an atom. In addition to their use as research tools, accelerators can be used as radiation sources to produce radioisotopes and to sterilize food and drugs. The major occupational groups employed in the manufacture of these machines are mechanical and electronic engineers, physicists, electronic technicians, draftsmen, and machinists.

Instrument Manufacturing. Many thousands of workers were employed in 1958 in manufacturing instruments for the atomic energy field. Production of these instruments involves work similar to that in instrument manufacturing in general. Professional and technical employees represent a large proportion of employment in most companies. Engineers are the largest scientific group. Physicists, chemists, and draftsmen are also employed. Among the craftsmen are modelmakers, machinists, and instrument makers.

Construction of Facilities. Thousands of workers are engaged in designing, engineering, and constructing nuclear reactor housing, atomic energy laboratories, reactor manufacturing plants, and reactor fuel processing plants. Several companies specialize in planning and designing these installations and provide consulting engineering help to companies doing the actual construction. In these companies, engineers, designers, and draftsmen made up more than 50 percent of total employment in 1958. Companies undertaking the actual construction employ all construction crafts including boilermakers, bricklayers, carpenters, cement finishers, steamfitters, plumbers, painters, electricians, ironworkers, sheet-metal workers, and operating engineers.



COURTESY OF ATOMIC ENERGY COMMISSION

Reactor operators loading long aluminum tubes containing pure uranium metal into a nuclear reactor.

Reactor and Accelerator Operations and Maintenance. Many nuclear reactors were operating in 1958 in Atomic Energy Commission and privately owned facilities as well as in nuclear-powered submarines. Occupations typically needed for the operation of reactors include reactor engineers, health physicists, reactor operators, and technicians. Among the employees needed to maintain and repair reactors are instrument engineers, instrument technicians, electricians, plumbers, mechanics, and machinists.

Most of the accelerators (atom-smashing machines) operating in 1958 were located at Commission-owned laboratories or at universities. The major occupations involved in the operation and maintenance of these machines are physicists, electronic engineers, electronic technicians, and accelerator operators.

Research and Development Centers. Research and development centers that are operated by private organizations for the Atomic Energy Commission employed about 36,000 workers in 1958. These workers devoted most of their time to atomic energy research which involves the use of laboratory facilities, machine shops, welding and sheet-metal shops, reactors, and particle accelerators.

Employment in typical centers was distributed among major occupational groups in the following proportions.

	Percent
Total employment	100
Managerial, supervisory, and professional	40
Clerical	13
Technicians and craftsmen	29
Maintenance	9
Other workers	9

Engineers and scientists made up more than 27 percent of total employment in these centers. Engineers alone accounted for nearly 13 percent; physicists, 5 percent; and chemists, 5 percent. Technicians and craftsmen accounted for 17 percent and 3 percent, respectively, of the total employment.

Government Employment. The Atomic Energy Commission, in directing the Federal Government's atomic energy program, employed about 7,100 persons in its national and field offices in 1958. Scientific and engineering personnel accounted for almost 17 percent of this total. Included were a large proportion of engineers, chemists, and physicists. Managerial and other professional personnel accounted for another 25 percent of total employment.

In addition to employees at the Atomic Energy Commission, there are Government employees engaged in atomic energy work in other Federal agencies and in labor and health departments in the individual States. Their duties involve research and application of atomic energy and preparation and implementation of radiation health and safety measures.

The U.S. Department of Defense employs engineers, as well as nuclear physicists, nuclear chemists, health physicists, geophysicists, metallurgists, and mathematicians in its atomic energy work. The U.S. Geological Survey employs geophysicists, geologists, chemists, physicists, and many other supporting employees. The U.S. Department of Agriculture uses radioisotopes extensively in research work. Included among these research workers are chemists, entomologists, plant physiologists, and soil scientists. Engineers are employed by the Maritime Commission to work on the development of nuclear-powered merchant ships.

The U.S. Department of Health, Education, and Welfare is concerned with radiation health hazards. With the cooperation of the Atomic Energy Commission, it aids States in establishing measures to meet this problem. The Department had engineers, physicists, chemists, and doctors engaged in this work in 1958. The U.S. Department of Labor is also interested in industrial safety problems in the atomic energy field. (A detailed discussion of the duties, training, and general employment outlook for most of the occupations discussed in the preceding sections appears elsewhere in this Handbook. See index for page numbers.)

Unique Atomic Energy Occupations. • The preceding discussion dealt in broad terms with occupational employment in various atomic energy activities. Most of these occupations are found in other industrial activities; however, there are a few which are relatively unique to the atomic energy field and for this reason are discussed more fully below:

Health physicists are concerned with the problem of radiation safety for workers in atomic energy installations and for people in the surrounding community. Health physicists protect individuals and property from the hazards of radiation by detecting the radiation and controlling exposures. They are professional workers with considerable responsibility and usually are assisted by junior health physicists, health physics technicians, and inspectors or monitors.

The excellent radiation safety record in the 12 years of Commission operation of the Nation's atomic energy program is a testament to the effectiveness of radiological protection techniques that the health physicists have developed.

Health physicists are responsible for planning and organizing various phases of an atomic energy facility's health program. They set up standards of inspection and establish procedures for eliminating radiological hazards. In some cases, they are employed on experimental and

COURTESY OF ATOMIC ENERGY COMMISSION

A health physicist (left) using a survey meter containing a geiger counter to make sure that personnel are not exposed to dangerous amounts of radiation.

developmental projects involving radiological toxicity. They may also plan and supervise training programs in respect to radiation hazards and direct surveys on radiological hazards or radiochemical toxicology.

These highly trained workers also supervise the inspection of work areas and equipment where radiation hazards exist and investigate specific problems involving hazardous materials. In addition, they assist in the development of better methods and equipment for detection and control. Another duty involves the preparation of routine and special reports on radioactive materials.

Health physicists recommend procedures for protecting employees and prepare instructions for use by operational workers. Shipments of equipment and materials are inspected to insure compliance with Government standards and regulations. They also cooperate with plant doctors in initiating and scheduling medical examinations. Finally, they may recommend procedures to be followed in using radiotoxicants in research and developmental processes.

These scientists are employed at nuclear reactor sites and wherever sizable amounts of radioactive materials are on hand. Frequently, their jobs are located away from populated areas.

Health physics technicians generally work under the supervision of a health physicist. They process, read, and record data from radiation monitoring film and perform other special studies involving the use of a microscope. Some of their other duties include checking and servicing radiation instruments and checking clothing with special radiation-counting equipment. In some cases, they may be engaged in experimental work.

Health physics inspectors or monitors use special instruments in checking work areas, tools, and equipment for radiation and radioactive contamination. They determine whether an area is safe to work in and whether equipment is safe to use. Inspectors set safe working time limits for employees in hazardous areas in relation to radiation tolerances. They also check incoming and outgoing shipments of radioisotopes for radiation levels and contamination. Soil and water samples are taken in waste disposal areas and their radioactivity measured. Finally, inspectors make reports and give oral advice concerning radiation hazards. They work under the supervision of health physicists.

Decontamination technicians, sometimes called reclamation men, have the primary function of decontaminating people, equipment, plant areas, and materials exposed to radiation. Using radiation-detection instruments to locate the contamination, they eliminate it by the use of special equipment and detergents and chemicals, and then verify the effectiveness of the decontamination measures. They may dismantle and assemble machinery, electrical apparatus, and plumbing in the process of decontamination.

Other health physics occupations include job specialties in addition to the four principal health physics occupations described above. There are, for example, workers who transport and dispose of radioactive materials; also, a group of operators who use equipment for treating waste water, sewage, and other materials to reduce the amount of radiation. They are assisted by helpers and laborers. Radiation safety representatives promote safety programs and supervise safety coverage in an assigned area. Some workers specialize in the maintenance and calibration of detection instruments.

Training and Other Qualifications

Some special training is required for a number of workers in the atomic energy field because of the relative newness of the field, the rigorous work standards in both its research and production activities, and the field's unique health and safety problems.

There are stricter performance requirements for some of the craft jobs. Plumbers, pipefitters, machinists, boilermakers, electricians, and welders may be required to work to somewhat more exacting tolerances than those required in most industrial work. This kind of precision is needed to insure safety and health protection in constructing and maintaining atomic reactors and related equipment. Some unions have devoted particular attention in their regular training programs to the special work requirements in the atomic energy field.

However, the training and educational requirements for most workers in atomic energy activities are generally similar to those required for comparable jobs in other fields (except for the safety and health problems) and are discussed elsewhere in this Handbook under the specific occupations. (See index for page numbers.)

The initial occupational needs of the atomic energy field were met through on-the-job and specialized training programs given by the Atomic Energy Commission and its contractors. Many of these training programs are still in operation. The Commission supports an extensive educational program to assist in preparing trained scientists, engineers, technicians, and other workers for the growing atomic energy field. The AEC conducts training schools, trains people at its contractor-operated facilities, offers special fellowships, and provides materials and financial aid to educational institutions.

The Commission sponsors a graduate level school, the International School of Nuclear Science and Engineering, to train scientists and engineers in the design and development of reactor systems. The school is operated by the University of Chicago, at the Commission's Argonne National Laboratory in Chicago, Illinois. This is an unclassified school (security clearance unnecessary) which accepts students sponsored by United States firms and foreign nationals. A minimum of a bachelor's degree in science or engineering with high academic standing is usually required. Two sessions are conducted each year with about 65 students in each session.

The Oak Ridge Institute of Nuclear Studies, which conducts a school to train doctors, scientists, and engineers in the safe and efficient use of radioisotopes, is run by an association of 36 colleges under contract at the Commission's Oak Ridge installation. A 28-day course is offered about 6 times a year. Since the opening of the school in 1948 more than 2,800 scientists have participated in this program.

Additional educational and training opportunities are offered in cooperative programs arranged for by the Commission laboratories with colleges and universities. Temporary employment at AEC-owned laboratories is available to faculty members and students; engineering undergraduates may work at the laboratories and other Commission facilities on a rotation basis with classroom work; and graduate students may do their thesis work at laboratories.

The laboratories also offer on-the-job training to personnel from industry, government agencies, and the Armed Forces. Some Commission contractors offer technical and graduate instruction at their own plants or at nearby colleges to fit new employees into their organizations or to give further training to personnel already employed. Employees may be reimbursed for tuition costs or may be given time off during their workday to take these courses.

Several kinds of graduate fellowships are offered by the Commission. Fellowships in radiological (or health) physics provide for 9 months of training at a university, plus 3 months at a Commission laboratory. Eighty-four such appointments were made for the 1957–58 school year. Approximately eight fellowships are granted each year in both industrial hygiene (the evaluation and control of industrial health hazards) and industrial medicine. The largest number of fellowships are offered for the study of nuclear energy technology. These are awarded to students accepted by a college or university where a program of graduate study in nuclear energy technology has been developed comparable to the 1-year course of study at Commission schools. Thirty-six schools are participating in this program.

The Commission also helps colleges and universities set up facilities for the training of scientists and engineers in nuclear energy technology. Direct aid is offered for the purchase of teaching aids and laboratory equipment, including reactors. Grants totaling about $9 million have been made to 95 educational institutions under this program. Twenty-three awards have been made for the purchase of training and research reactors. The Commission has given further aid by lending uranium and neutron sources to schools without charge.

Under another program, the Atomic Energy Commission has awarded 90 grants, totaling more than $1 million, to assist colleges and universities in equipping their laboratories for training in nuclear technology as applied to the life sciences. The Commission also conducts summer institutes at its laboratories to train faculty members of colleges, technical schools, and high schools.

In the last few years colleges and universities have rapidly expanded their facilities and curriculums in order to provide training in atomic energy. While introductory or background courses may be taken at the undergraduate level, engineers and scientists generally take graduate work in order to specialize in the atomic energy field. Some colleges and universities award graduate degrees in nuclear engineering or science. Others offer graduate training in nuclear engineering or science, but award degrees only in the older engineering specialties.

The following discussion of training, education, and other qualifications relates to jobs which are unique in the field of atomic energy. A great number of scientists and engineers are employed in this field. For some positions, specialized training in nuclear energy is not required, although some basic knowledge of the field is preferred. However, specialized knowledge is essential for many engineers and scientists engaged in research, development, and design work. This may be obtained through graduate work at a university, at a Commission school, or through on-the-job training. The emphasis of such training is on problems dealing with the properties and control of radiation and its effects on materials.

A bachelor's degree in physics, chemistry, or engineering and about 1 year of graduate work in health physics are preferred by employers of health physicists. In some cases, related technical training and experience can be substituted for part of the academic requirement. Under the Commission's fellowship program, health physicists attend lectures at a university during the academic year. During the summer months, at Commission installations, they undertake work involving problems of monitoring (measurement of radiation level), instrument adjustment, shielding, and waste disposal associated with reactors, high-voltage machines, metal-preparation and metal-recovery laboratories and plants.

Some of the other unique health physics occupations do not require college training. For example, a high school education and some experience in health physics work or equivalent special training or education is required for the job of the health physics technician. Familiarity with electronic instruments and laboratory techniques are essential requirements. Special training in health physics and a high school education are requisites for inspectors or monitors. These workers must be familiar with some of the characteristics of radiation, maximum permissible exposure values, and methods of calculating exposure times. They must also know how to use radiation detection instruments. High school graduates, after receiving some formal technical instruction and on-the-job training, can become decontamination technicians. They are regarded as fully qualified after 15 months' experience on the job.

Originally, a college degree was a minimum requirement for a reactor operator, but high school graduates now often qualify. The operator needs a good understanding of, and familiarity with, the reactor controls and their purposes. Specialized training is given on the job and the amount of time needed for this training depends on the type of reactor and the aptitude of the trainee. Generally it takes only a week—mostly of classroom type training—to become competent in the operation of small reactors. To operate higher power reactors, it may take several weeks of training including 15 or 20 hours at the control console. Upon completion of the training period, and as a prerequisite for a license issued by the Atomic Energy Commission, the trainee must pass an operating test, a written test given by the Commission, and a medical examination.

High school graduates can now generally qualify as accelerator operators, except on very-high-energy machines where they need to have either a thorough background in electronics or training as an electronic technician. He must be adept with his hands in order to perform mechanical repair work, and be careful and conscientious because of the possible radiation dangers and the high cost of damage to very expensive equipment. On-the-job training is given covering operating procedures and repair and safety. This training may range from 2 to 7 months, depending on the type of accelerator. An experienced graduate engineer or physicist serves as the operations and maintenance supervisor for both reactors and accelerators.

Individuals who handle classified data or who work on classified projects in the atomic energy field must have a security clearance, which consists of an investigation of a person's character, loyalty, and associations. All Atomic Energy Commission employees pass this investigation.

Employment Outlook

Atomic energy is a relatively new field which promises long-range growth in employment. There will be an increased need for trained professional and skilled personnel in the expanding number of activities growing out of the widespread application of nuclear energy. At the present time, most of the employment is in research and development.

Additional nuclear fuel processing activities will probably result in increasing employment in uranium refining and processing operations. Growth in reactor manufacturing employment is also expected. Plants which fabricate fuel elements and offer services for waste disposal and fuel reprocessing are also expected to increase their employment.

In late 1957, the Nation's first full-scale nuclear powerplant designed for the production of civilian electric power went into operation at Shippingport, Pa. Four additional plants are expected to be completed by 1961. These and other plants which will be completed in the 1960's will offer employment opportunities for reactor operating and maintenance personnel. Other sources of employment will be in universities and industrial laboratories having reactors.

Employment expansion can also be expected in laboratories processing radioisotopes. Employment may substantially increase in plants making control equipment and radiation recording and detection instruments because of the general expansion in the atomic energy field.

Trained technical workers and skilled craftsmen will be required in considerable numbers in the 1960's in nuclear energy activities. Particular need will exist for chemists, nuclear physicists, mathematicians, biologists, biochemists, metallurgists, nuclear and other types of engineers, technicians, and people in the health physics occupations. There will also be an increased need for skilled workers, such as welders, sheet-metal workers, machinists, pipefitters, and tool and die makers.

Earnings and Working Conditions

Information on earnings in individual occupations in atomic energy activities is not available. However, indications are that the earnings in some nuclear energy activities were higher than in comparable nonnuclear energy occupations. In April 1959, production workers employed by private contractors at the Atomic Energy Commission's installations were averaging $2.67 in straight-time hourly earnings. This compares, for example, with the gross average of $2.23 for all production workers in manufacturing industries in the same month. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on those occupations elsewhere in this Handbook. See index for page numbers.)

Most workers in the atomic energy field receive 2 or 3 weeks' vacation with pay, depending on their length of service. In addition, most firms have group life, health, and accident insurance and retirement plans.

Working conditions in the atomic energy field vary with the type of job and the place of employment. In uranium mining, milling, instrument and auxiliary equipment manufacturing, and facilities construction, working conditions are similar to those for nonatomic energy activities of the same type. But in the other occupations which constitute the major proportion of the atomic energy field, working conditions generally are unusually good. Buildings and plants are relatively new and are well lighted and ventilated. In some cases, plants are located in remote areas. The surroundings are also pleasant, because the buildings are often spread out over wide land areas. Equipment, tools, and machines are modern and, sometimes, the most advanced of their type.

Health and safety are a primary concern. As a result, extensive safeguards have been established to protect workers. However, only a small proportion of employees in the atomic energy field work in areas where direct radiation dangers exist.

Most plant workers belong to unions. Among the unions which have members in the atomic energy field are unions in the Metal Trades Department, AFL-CIO, such as: The International Brotherhood of Electrical Workers; the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers, and Helpers; and the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada. The International Association of Machinists; the Oil, Chemical, and Atomic Workers International Union; and the International Chemical Workers Union also represent workers in this field.

Where To Go for More Information

Information about employment in the atomic energy field may be obtained by writing to the Office of Industrial Relations, Atomic Energy Commission, Washington 25, D.C.

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AUTOMOBILE MANUFACTURING OCCUPATIONS

In the brief 60-odd years of its existence, the automobile industry has grown from an experiment concerned with the development of a horseless carriage to one of the most important of America's manufacturing industries. This industry, which in the 1890's occupied the attention of a few inventive mechanics working in small sheds and shops, is now among the Nation's largest employers.

By the end of 1958, more than 68 million cars, trucks, and buses were traveling the Nation's streets and highways. Slightly more than 5 million of these motor vehicles were built during 1958. The industry has produced an average of nearly 7 million vehicles each year since 1950.

The automobile industry, like other large industries, is a source of employment for workers with widely different levels of education and skill. Requirements for jobs vary from college degrees for engineers and other professional and technical personnel to a few hours of on-the-job training for some of the less skilled assemblers, material handlers, and custodial workers. The largest number of employees work in factory occupations. These jobs range from the skilled tool and die makers, millwrights, and electricians, to the less skilled machine tool operators, assemblers, material handlers, and custodial workers. A great number of automotive employees also work in office and administrative jobs as clerks, business machine operators, stenographers, accountants, purchasing agents, market analysts, and industrial relations personnel.

Completed automobile about to be driven off the assembly line.

Nature and Location of the Industry

This industry has not only helped to develop existing industries but also has created new ones. It is the most important consumer of such basic commodities as steel, rubber, and plate glass. Moreover, many businesses, including automotive repair shops, service stations, and truck and bus transportation facilities, have been created as a result of the automobile.

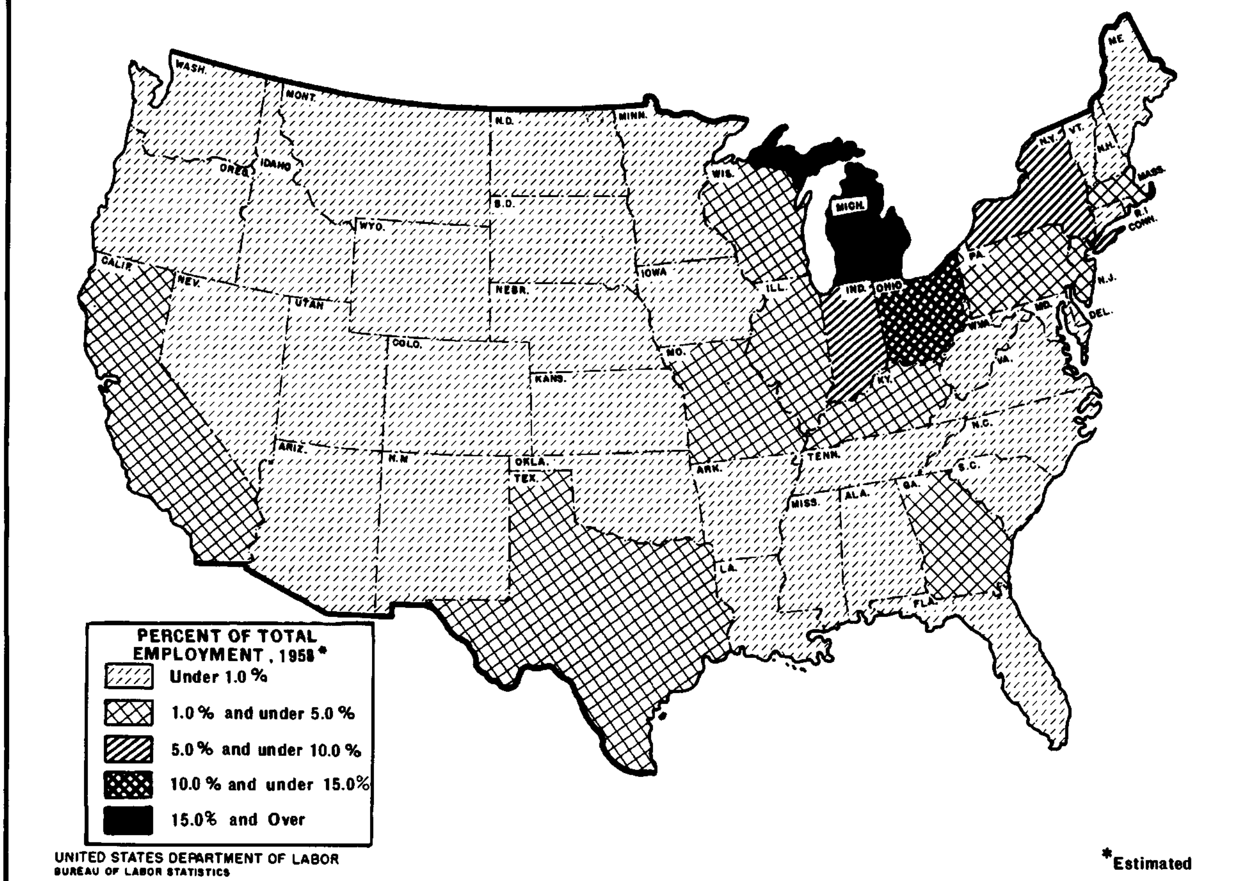
The tremendous growth of this industry is due primarily to the mass production of standardized parts. Thousands of identical parts are produced by workers whose jobs are divided into a limited number of operations on high-speed automatic machinery. These mass-produced parts are then put together by assemblers to form the completed vehicle. Because of the minute division of labor, cars can be driven off assembly lines at the astounding rate of 1 every 45 seconds.

The automobile industry consisted in 1958 of more than 2,000 plants which manufactured parts or subassemblies and assembled these parts into motor vehicles of all types. These plants ranged in size from huge assembly plants employing many thousands of workers to parts plants employing a small number of workers. About 55 percent of the automobile workers were employed in establishments with 2,500 or more employees.

Hundreds of companies supply the parts or subassemblies for new automobiles and also produce the replacement parts necessary to keep the millions of vehicles already on the road in operation. These firms often specialize in producing certain parts—for instance, brakes and clutches. About 35 percent of the automobile workers are employed in these parts-manufacturing plants. Only a few companies produce the completed vehicles—passenger cars, trucks, buses, and special-

CHART 34

AUTOMOBILE MANUFACTURING IS CONCENTRATED IN THE GREAT LAKES REGION



purpose vehicles, such as ambulances, fire engines, and taxicabs.

Jobs in the automobile industry are found in almost every State in the country. However, automobile manufacturing is concentrated in the Great Lakes region where about four-fifths of the workers are employed. Michigan alone accounted for nearly 50 percent of the industry's employment in 1958. Together, the three States of Ohio, Indiana, and New York had another 25 percent. Seven other States each employed 10,000 or more workers. They were California, Wisconsin, Illinois, New Jersey, Pennsylvania, Missouri, and Georgia. (See chart 34.)

The Detroit metropolitan area is the center of the industry. About one out of every three of the Nation's automobile workers is employed within its industrial area, which includes the nearby communities of Dearborn and Pontiac. Several other Michigan cities, especially Flint, Lansing, and Saginaw, employ large numbers of automobile workers. The Great Lakes region has many other important centers: Cleveland, Lorain, Toledo, and Cincinnati, Ohio; South Bend, Indianapolis, Evansville and Fort Wayne, Ind.; Chicago, Ill.; Buffalo, N.Y.; and Milwaukee and Kenosha, Wis.

Much of the automobile manufacturing on the East Coast is centered in the New York–Northeastern New Jersey–Philadelphia industrial area in such localities as Newark, Linden, and New Brunswick, N.J.; and New York and Tarrytown, N.Y. The Los Angeles industrial area is not only the leading automobile manufacturing center in the Pacific Coast region, but it is second only to Detroit in the number of motor vehicles assembled. The Bay area (Oakland) is another automobile manufacturing center in California.

How Automobiles Are Made

The modern automobile represents an engineering triumph matched by few other mechanical products. The mass production of standardized parts and assembly-line manufacturing methods enable the automobile industry to produce millions of these complex products each year.

Motor vehicles are produced in three major stages. The first step is the preliminary designing and engineering, the second is the production of motor vehicle parts and subassemblies, and the third is the final assembly of parts into completed vehicles.

Planning for New Model Production. Three to 4 years of designing and planning often precede the actual production of an autombile. Stylists constantly strive to improve the appearance of the automobile. They work closely with engineers and other technical personnel who are concerned with improving mechanical operation, design, and safety. The creative designs of the stylists are transferred to drafting boards and then skilled modelmakers convert the blueprints into clay, wood, and plastic models of the new automobile. From these models, the styling and design of the new car are developed.

For the mass production of the car, master dies are made from the finally accepted model. Throughout this initial stage of producing an automobile, parts companies work closely with the automobile manufacturers on questions of designing, engineering, and tooling. Problems of production methods, costs, and scheduling also are worked out long before the actual manufacturing process begins.

Stylist consulting with engineer regarding future automobile designs.

Making Automobile Parts. The manufacture of motor vehicle parts and subassemblies is the second stage of automobile production. After the design of the new model automobile is developed, automobile parts plants begin production of the various components of the car. Because parts are made by many different firms, rigid quality control is maintained to insure that the parts fit properly on the final assembly line. Quality control is also stressed to insure the safety of the finished automobile product.

Motor vehicle parts are made of many different materials. While most of the parts are made from steel, other materials such as copper, zinc, and aluminum also are used. Some of the parts contain plastic, rubber, fabric, or glass. Metal parts for motor vehicles can be shaped in several ways depending upon the purpose for which the part is to be used, the size of the part, and the type of metal used.

The principal methods of shaping metal are casting, forging, machining, and stamping. Most metal parts are produced by foundry workers, forge shop workers, machining workers, and operators of stamping or pressing machines.

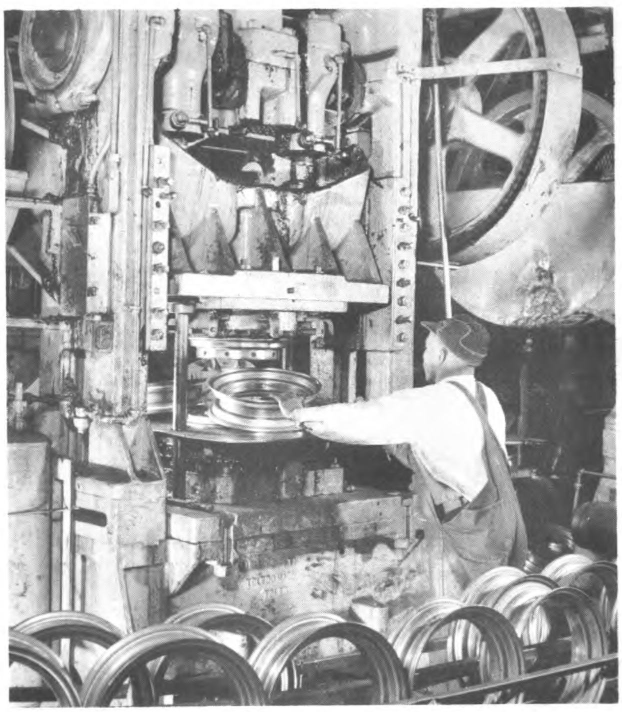
Castings are made in foundries where molten metal is poured into molds and allowed to cool and harden into the desired shape. Bulky parts, such as engine blocks, generally are made by the casting process. In the forge shops, metal is heated and then shaped into the desired form by mechanical steam hammers and forging presses.

The forging process shapes metal objects which are required to withstand great stress, such as automobile crankshafts and connecting rods. Generally, parts that are produced by casting or forging must undergo further processing, usually machining, before being ready for assembly.

Machining is the metalworking process generally best adapted for the production of parts to precise sizes. It is a process of cutting or chipping excess metal from rough castings, forgings, and bars by the use of power-driven machine tools. Among the more common types of machine tools are lathes, boring machines, drill presses, broaches, grinding machines, milling machines, and gear cutters. The machine tools are used to turn, drill, grind, cut, and finish metal parts to exact sizes. Hundreds of machining operations are required to complete some of the more intricate parts, such as engine blocks, pistons, ring gears, connecting rods, camshafts, and crankshafts.

The automobile industry has taken the lead in trying to develop continuous automatic production for many of its machining operations. This approach to production has been called "automation," i.e., the use of instruments to direct and control manufacturing processes. In applying automation to machining processes, automobile manufacturers have linked automatic machine tools to perform a variety of machining operations. Less labor is required because the parts or pieces being machined are not handled manually.

For example, one large motor vehicle producer has built an automated engine plant in which a rough engine block goes through 530 different cutting, drilling, and grinding operations with the use of little or no manual labor. The engine block is moved into and out of load stations mechanically, machined automatically by a battery of machine tools, and transferred by conveyors to the next machining operation. Much of the inspection is done automatically. The machine tools, the conveyors, and the inspection equipment often are controlled by electronic, hy-



Press operator removing a wheel rim.

draulic, or air control mechanisms. Workers attend the automated lines of machine tools by watching the panel-control-boards for interruptions of the machines' normal functioning.

Another important manufacturing operation is the metal stamping process. The large sections of the body of the car are formed from sheet steel shaped by huge electronically controlled presses. Smaller parts of the vehicle also are stamped or pressed out of sheet steel or aluminum.

The production of parts does not entirely consist of metalworking operations. For example, to make body parts rustproof and attractive, they are spray painted and then baked in ovens lined with infrared lights. Also, upholstery for the car interior is cut, sewn, and installed.

Throughout the production of parts, numerous inspections are made to insure that the quality of the assembled vehicles will meet established standards. Such inspection begins with a spot check of incoming raw materials from which parts are to be made. All machined parts are carefully inspected so that they will not vary from the specified size limits.

Assembling the Final Product. The last stage of motor vehicle manufacturing takes place on the final assembly line. Final assembly is the process of putting together in sequence the individual parts and the subassemblies, with the completed vehicle rolling off the end of the line. Overhead wires feed electric power to nut tighteners, welding equipment, and other tools used by workers on the assembly line. A conveyor carries the motor vehicle forward while men at work stations attach the necessary parts and subassemblies in proper sequence.

Generally, the assembly of a car starts with the frame which forms the foundation of the motor vehicle. All other parts and subassemblies are attached to it. Large and heavy subassemblies, such as the engine and the body, are lowered by hoists into position on the chassis as it comes down the line. The finishing accessories, such as bumpers, hubcaps, and floor mats, are added near the end of the line. Finally, the headlights are adjusted, the wheels are alined, and gasoline is pumped into the fuel tank, and thus another new motor vehicle is driven off the line under its own power. The finished car is inspected before it leaves the factory.

As the many chassis move down the assembly line, "banks" of material located in aisles along the line are continually fed to the assemblers in accordance with a careful system of scheduling arranged by the production control department. Behind the movement of the parts and subassemblies to the assembly line is the work of the materials control men who, months before, coordinated the movement of material from outside suppliers with a planned production schedule.

The sequence of the models to be built may be transmitted to the various stations along the line by either teletype or telautograph. The information on color and on the special equipment desired in each car is obtained from car orders placed by automobile dealers. By this scheduling program, cars of different colors and types follow each other down the assembly line—for example, a light blue sedan may be followed by a beige station wagon.

Automobile Manufacturing Occupations

About 725,000 workers were employed in hundreds of occupations in the automobile industry in early 1959. Approximately 5 percent of the workers were employed in engineering, drafting, chemical, metallurgical, and other technical jobs; nearly 20 percent were in administrative, supervisory, and clerical positions. The rest of the automobile workers were employed in assembling, metalworking, inspecting, material handling, maintenance, and other plant occupations. The duties and training requirements of some of the important occupations are described briefly below.

Professional and Technical Occupations. The modern automobile is a product of the research, design, and developmental work of thousands of engineers, chemists, metallurgists, physicists, mathematicians, statisticians, and other professional and technical personnel employed by the automobile companies. Engineers make up the largest group of professional and technical workers in the automobile industry. Automobile companies hire engineers specializing in mechanical, electrical, industrial, metallurgical and other fields. For example, the mechanical engineer continually seeks ways of improving the engine, transmission, or other parts of the automobile through research and development and better design. The electrical engineer works on electrical parts such as voltage regulators and generators. The industrial engineer concentrates on the layout of plant equipment, improved processes, and production scheduling. The industry also employs civil, chemical, and ceramic engineers. Some engineers are employed in safety and sales work.

Although most of these professional workers are employed in research and development departments, some also supervise the more technical production jobs. For example, a metallurgist may be employed to supervise the melting operations in the precision casting and forging departments.

The industry employs many semiprofessional workers or technicians, such as draftsmen, engineering aids, laboratory assistants, and other technical aids to assist engineering and scientific workers. (A detailed discussion of the duties, training, and general employment outlook for engineers, scientists, and technicians appears elsewhere in this Handbook. See index for page numbers.)

Administrative, Clerical, and Related Occupations. Many types of workers are employed in the industry to perform the many administrative functions needed to operate the automobile companies. Included in this group are executives, who determine, among other things, how many vehicles to produce, what styles to make, what prices to charge, which parts the company should produce and which parts it should buy, and where it is best to locate plants. On the second level of administrative jobs are those such as personnel manager and purchasing agent, who direct individual departments or special phases of operations. Among those who assist the administrators are accountants, lawyers, market analysts, economists, statisticians, and industrial relations experts. This large industry also has many supervisory employees in charge of specific groups of office or plant workers.

A large staff of clerical workers also is employed by the industry. Included are secretaries, stenographers, bookkeepers, clerks and typists, and business machine operators. A large proportion of these office workers are women. (A detailed discussion of the duties, training, and general employment outlook for administrative and clerical workers appears elsewhere in this Handbook. See index for page numbers.)

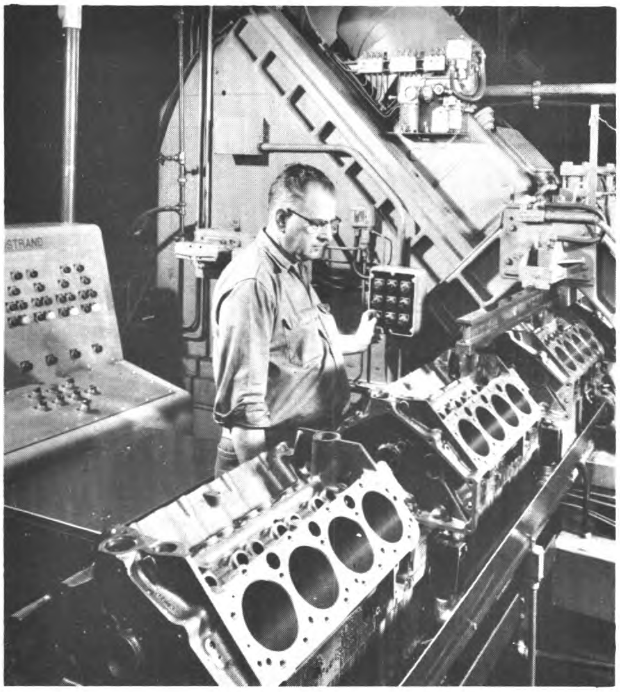
Plant Occupations. The largest group of workers in the automobile industry (about 75 percent) is employed in factory jobs. Most of these workers make automobile parts, assemble them into the complete vehicles, and put the finishing touches on the cars and trucks. Other plant workers service and maintain the vast amount of machinery and equipment needed for automobile manufacturing. The plant work force is predominantly male. About 7 percent of assembly plant workers and about 15 percent of the workers in automobile parts plants in mid-1957 were women.

After the stylists, engineers, and draftsmen have planned and designed the new model car, the production process gets under way. First, the parts must be made. Parts are principally metal and are shaped by a variety of metalforming processes requiring workers in a number of metalworking occupations. For example, bodies must be stamped out by huge presses, cylinder blocks must be cast in foundries, crankshafts must be forged in forge shops, and pistons must be ground by machine tools.

Machining occupations. The modern automobile is a complex machine consisting of thousands of metal parts made to exact specifications. Many of these parts are manufactured to precise dimensions by machining workers. One of the largest metalworking occupations in the automobile industry is that of machine tool operator—about 70,000 in mid-1957. These workers operate power-driven machines (machine tools) which hold both the piece of metal to be cut and a cutting instrument, or "tool," and bring them together so that the metal can be cut, shaped, drilled, or ground. These workers are designated according to the type of machine tool they operate. Some of their job titles are engine lathe operator, drill press operator, and milling machine operator.

The most highly skilled machining workers are the tool and die makers. The automobile industry employed about 15,000 to 20,000 of these skilled workers in mid-1957. Toolmakers make the jigs, fixtures, and other accessories that hold the work which is being machined. Diemakers construct the dies that are used in stamping, pressing, forging, and other metalforming operations. Tool and die makers read blueprints, set up and operate machine tools, use precision measuring instruments, and make shop computations in their work. They must work to closer tolerance (more exact dimensions) and do more precision handwork than most other machining workers. (A detailed discussion of the duties, training, and general employment outlook for tool and die makers and other machining workers appears elsewhere in this Handbook. See index for page numbers.)

Foundry occupations. Some parts of the automobile are made in foundry departments which make castings for such units as engine blocks. Castings are produced by pouring metal into molds where it cools and hardens in the shape of the molds. Patternmakers make a wood or metal pattern in the shape of the final casting desired. Machine molders make the sand mold into which the metal is poured. Coremakers shape the bodies of sand, or "cores," which are placed inside molds in order to form hollow spaces needed in castings.



Highly automatic machines are used in automobile engine production. Here one man operates a machine which bores cylinders into engine blocks.

Many other workers are in less skilled occupations in the foundries. Melters operate furnaces used to melt metal for castings. The actual pouring is done by pourers. After the casting cools, the shakeout men remove it from the mold. Other workers clean the castings and remove the excess metal. (A more complete description of the foundry jobs may be found in the chapter on Foundry Occupations. See index for page numbers.)

Forging occupations. Some automobile parts, such as crankshafts and connecting rods, which are required to withstand great stress, are shaped by forging hammers and presses in the forge shop. Hammermen operate drop hammers which pound metal into various shapes between closed dies. The hammermen are assisted by heaters who heat the metal stock in a furnace to prepare it for forging and then pass the stock to the hammermen. Other forge shop workers are engaged in cleaning, finishing, heat treating, or inspecting forgings. (A more complete description of forge shop jobs may be found in the chapter on Forge Shop Occupations. See index for page numbers.)

Other metalworking occupations. The automobile industry employs large numbers of workers in other metalworking occupations. Included among these are punch press operators who run power-driven presses which vary in size from small presses used for forming brackets, clips, or other small parts, to the massive presses which form, trim, and pierce holes in the doors, body panels, and frame. Punch press operators in this industry numbered more than 30,000 in mid-1957.

Automobile plants employed about 25,000 welders in mid-1957. These welders operate equipment used to join metal parts. Welding can be performed manually or by machine. Some manual electric-arc welders and gas welders work in production jobs in parts and body manufacturing plants, and other work in maintenance jobs repairing and rebuilding machinery and equipment. Machine (resistance) welders are primarily employed on the assembly lines welding the separate parts of the bodies and subassemblies. (Detailed discussions of the duties, training, and general employment outlook for foundry, forging, and other metalworking occupations appear elsewhere in this Handbook. See index for page numbers.)

Assembling occupations (D.O.T. 5–02.300 through .399, 5–25.570, 7–02.300 through .399, and 9–02.01, and .81). The workers who do the assembling make up the largest occupational group in the automobile industry. In mid-1957, more than 125,000 of these workers were employed. They represented approximately 18 percent of all automobile workers. Assemblers may work on small units or subassemblies or they may assemble large units. Those employed on subassemblies may work in parts plants or on the subassembly lines of the larger automobile manufacturers. Line assemblers work on the final assembly line where they may bolt parts and subassemblies to make the completed car.

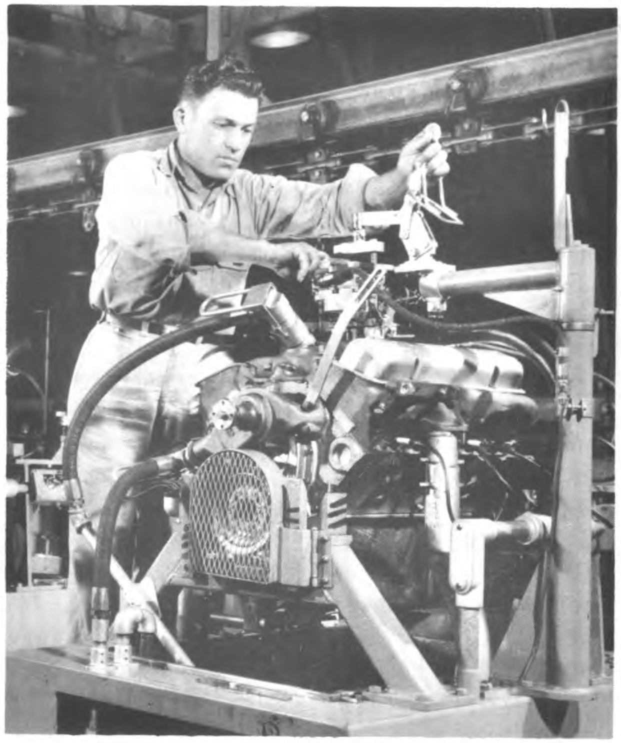
Most assembly jobs are repetitive and require little skill; however, they do require coordination and may be strenuous. Division of labor is carried to its extreme degree on the assembly line. For example, one worker may start nuts on bolts and the next worker may tighten the nuts with a power-driven tool called a nut-runner. Each worker is assigned the amount of work he can do within the time it takes the automobile to pass his work station.

Inspection occupations (D.O.T. 5–02.700 through .799, 5–81.630, 6–78.671, and 7–02.700 through .799). Automobiles can be produced on a mass basis because parts and assemblies for the same make of automobile are interchangeable. They are made to exact measurements and are subject to close quality control and inspection. (The industry employs statisticians and engineers in quality control departments who use statistical techniques designed to control the quality of the product.) In mid-1957, about 36,000 inspectors and testers were employed in the automobile industry.

Inspectors check raw materials when received, examine parts during the manufacturing stages, and make quality and conformity checks during the subassembly and assembly operations. Micrometers, specially designed gauges, and other measuring and testing instruments are used by inspectors and testers in carrying out their duties.

Finishing occupations. Many finishing operations must be performed before a car is completed. For example, the metal surfaces must be readied for finishing, the exteriors painted, the interiors covered, the seats upholstered, and finally, the finished product must undergo a thorough inspection. Among those employed in the finishing departments are metal finishers, platers,

Final assemblers "drop" front end of automobile into position.



Inspector checking engine in final operational test before installation in automobile.

sprayers, polishers, sanders, trim cutters, sewing machine operators, and trimmers. *Metal finishers* (D.O.T. 6–77.040, and .530 and 8–77.10) file and polish rough surface areas of metal parts in preparation for painting. *Platers* put a thin coat of metal on automobile bumpers and "hardware" for ornamentation and protection against corrosion. *Sprayers* (D.O.T. 7–16.210, and .500 through .629) operate spray guns to apply paint or other finishes to the metal parts. *Polishers* (D.O.T. 6–77.020, .025, .080, and .330) rub the finished surfaces by hand or polish them with a portable motor-driven buffing wheel.

Cutters, sewing machine operators, and trimmers combine their skills to provide comfortable and attractive interiors. With hand shears or an electric knife, the *cutter* (D.O.T. 4–62.020 and 6–27.054) cuts fabric or leather to the specific shape according to a pattern. The *sewing machine operator* (D.O.T. 6–27.503), using a power-driven machine, sews together the upholstery sections after they have been cut to size. *Trimmers* (D.O.T. 4–35.610), who numbered about 10,000 in mid-1957, arrange and fasten springs and padding or foam rubber for the seats and backs, and tack the covering material in place.

Material handling, custodial, and plant protection occupations. The production of motor vehicles by the assembly-line process requires an elaborate system of material movement to supply the assembly lines and to remove finished products. A considerable number of workers are employed in moving materials in automobile and automobile parts plants. Drivers, numbering more than 13,000 in mid-1957, are employed to drive power trucks to deliver parts or subassemblies to the assembly line or to move materials between plants. Material handlers, who numbered about 25,000 in mid-1957, load and unload material from trucks or into and out of containers. Crane operators use machines to move raw steel stock, heavy dies, and other materials that are too heavy for material handlers to lift by hand.

Many persons are needed to keep the production workers supplied with tools, parts, and materials, and to keep records of materials. Factory clerks, such as checkers, stock chasers, and stock clerks, coordinate the delivery of parts to the proper location on the assembly line. They check, receive, and distribute materials and keep records of incoming and outgoing shipments.

The automobile industry also employed many workers who engaged in plant protection and custodial work. These workers include plant patrolmen, gatemen, janitors, and porters.

Maintenance occupations. A large staff is required to keep machines and equipment in good operating condition and to make changes in the layout of automobile plants. Because breakdowns in the assembly lines and in the highly mechanized machining lines are particularly costly, the automobile industry employs many skilled maintenance employees to service this complicated production system. The maintenance and repair of complex electrical, electronic, and hydraulic equipment require well-trained electricians, electronic technicians, and machinery repairmen. Millwrights numbering about 7,500 in mid-1957 were employed to move, install, and maintain heavy machinery and mechanical equipment. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Other maintenance workers employed in automobile plants include carpenters, stationary engineers, and sheet-metal workers. (A detailed discussion of the duties, training, and general employment outlook for maintenance occupations appears elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

The training requirements for jobs in the automobile industry range from a few days of on-the-job training to years of preparation. Many of the unskilled workers can learn their jobs with a day or two of training. On the other hand, the engineering and scientific jobs, as well as craft jobs, are filled by persons who have spent years in training for their occupations.

The autombile industry's emphasis upon new design and mechanical improvements has made it an important employer of persons with engineering and scientific backgrounds. The minimum requirement for engineering jobs is a bachelor of science or a bachelor of engineering degree from a recognized college. Advanced degrees are often required for scientists, particularly for those engaged in research and development work. Many of the companies give their newly hired engineers and scientists specialized training courses. It is from this group of professional workers that some companies have selected many of their top executives.

The requirements for other technical workers vary according to their specialties. For example, technical institute or junior college graduates are employed as engineering aids, laboratory assistants, and draftsmen. Some automobile companies train their own semiprofessional technical workers at company-run schools or subsidize students at local junior colleges or technical institutes. These workers may also take advance training and acquire engineering degrees.

Administrative positions are usually filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations or other specialized fields. Some companies have advanced training programs for workers in these specialties. Many of the top administrative jobs are filled by promotion from within the organization.

Most autombile firms hire persons who have had commercial courses in high schools or business schools for office jobs such as clerks, bookkeepers, stenographers, and typists. These workers usually have not been trained specifically for jobs in this industry.

The training requirements for factory jobs vary considerably. As noted earlier, many assembling jobs can be learned in a few hours or days. Some of the less skilled machine tool operating jobs can be learned in a few weeks. The more skilled machine tool jobs require 1 or 2 years of on-the-job training.

The automobile industry hires thousands of workers for craft jobs which require extensive periods of training. Tool and die makers, patternmakers, electricians, millwrights, and machinery repairmen are some of the highly skilled workers who generally require at least 3 or 4 years of training before they can perform their specialized jobs. Although many of the workers in craft jobs have picked up the skills of their trade by working with experienced workers, most training authorities agree that apprenticeship training is the best way to learn a skilled trade. Automobile firms, in cooperation with labor unions, conduct apprenticeship programs for many of the skilled trades. The industry's apprenticeship program enables several thousands of young men each year to prepare themselves for skilled jobs such as machinists, millwrights, pipefitters, tool and die makers, patternmakers, maintenance electricians, and machinery repairmen.

Applicants for apprenticeship training are generally required to be between the ages of 18 and 26 (age limitations are waived for veterans and for workers already employed in automobile companies) and graduates of a high school, trade, or vocational school. Training authorities stress that young persons interested in apprenticeship training should prepare themselves by taking courses in mathematics and other sciences. Apprentice applicants are given physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship training includes both on-the-job training and classroom instruction related to the occupation. Mathematics, blueprint reading, shop theory, and specialized subjects are studied in the classroom while the operation and use of tools of a particular trade are learned in the shop.

Most automobile companies select their foremen from among workers already employed. Frequently, persons who have completed apprenticeship training in a company are selected for supervisory jobs after they have acquired further experience. Applicants for foreman jobs go through a preliminary training period before they are eligible for promotion to the foreman level.

Employment Outlook

The automobile industry will provide thousands of job opportunities for new workers during the 1960's. Many of the new job openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Retirements and deaths alone should result in an average of 15,000 to 17,000 openings annually during the 1960–70 decade.

Although employment in this industry has been characterized by rather sharp fluctuations, the long-term trend of employment has been upward. Thus, from an industry which offered employment to only about 3,000 workers at the beginning of the 20th century, the automobile industry has become one of the Nation's largest employers.

Since the end of World War II, employment in the automobile industry has fluctuated sharply in response to such factors as changes in general business conditions, shifts in consumer preference, availability of credit, and mobilization needs.

The sale of automobiles is considerably affected by downturns in economic activity. The business declines which occurred in 1949, 1954, and 1957–58, resulted in sharp drops in the industry's employment. For example, employment in 1958 averaged 631,000, 20 percent below the 786,000 level in 1957.

During the 1960's, employment is expected to regain the employment losses resulting from the 1957–58 downturn and rise significantly above the 1958 level. This rise in employment is anticipated because of the expected increase in the production of motor vehicles during the 1960–70 decade.

The primary factor affecting production and, therefore, employment is the demand for automobiles. Demand is in turn affected by such factors as the level of economic activity, the level of income and its distribution among income groups, the growth of population and household formation, the move to the suburbs, prices, and the growth of multiple car ownership. Another important element in the demand for motor vehicles is the total number of cars, trucks, or buses in use, because a certain percentage of new vehicles are needed each year to replace the cars which are scrapped. During a period of economic expansion or automotive design innovation, the volume of scrappage ordinarily increases as total registration increases. An examination of the above elements influencing the sale of automobiles indicates a long-term increase in the number of vehicles produced during the 1960's.

Another factor contributing to the growth of employment is the expected increase in the production of replacement parts. As the number of vehicles in use increase, more replacement parts will be needed.

Employment is not expected to increase as fast as production. The primary reason for this difference in rates of growth is related to the industry's emphasis upon mechanized production methods and automatic assembly operations which are expected to continue to result in increased output per worker. Planned expenditures for new plants and equipment also are expected to lead to further efficiencies in production which would tend to reduce the labor requirements of the automobile industry.

On the other hand, the addition of new or improved equipment in motor vehicles, greater complexity of design, and constant style changes could, to some extent, offset the effect of increased productivity. The introduction of power steering and air conditioners are recent examples of equipment changes which tend to offset reduced manufacturing man-hour requirements. On the other hand, if large-scale production of small economy cars is undertaken, fewer man-hours may be needed per automobile produced. However, if the sales of these cars should significantly increase total automobile sales, employment could be favorably affected.

As noted earlier, employment in the automobile industry is subject to rather sharp fluctuations. Not all occupational groups are equally affected by these wide swings in employment. For example, between 1957 and 1958, production worker (plant) employment dropped 24 percent, whereas, nonproduction (mainly white-collar) employment declined only 3 percent. Among the plant workers, craftsmen have been less affected by the swings in employment than the semiskilled and unskilled workers.

In the post-World War II period, the occupational distribution of the industry has been changing as a result of its emphasis upon research and development activity and its increasing dependence upon automatic manufacturing operations. An example of how the occupational distribution of the industry has been affected is demonstrated by the changes which occurred between 1950 and 1958. In 1950, production worker employment made up 85 percent of total employment and nonproduction worker employment represented 15 percent of the total. In 1958, nonproduction worker employment accounted for 25 percent of the industry's work force.

Continuing recent trends, the number of engineers, scientists, and other technical personnel is expected to increase at a faster rate than other occupational groups because of the anticipated expansion in research and development activities. The employment of skilled workers such as tool and die makers, millwrights, pipefitters, electricians, and machinery repairmen, also will grow at a relatively faster rate than most other occupational groups in the 1960–70 decade. Clerical and administrative workers are expected to increase at a somewhat faster rate than production worker employment, although the introduction of data-processing equipment may limit the growth of some clerical workers. There will be a growing need for stenographers and typists. Accountants will be needed in greater numbers in the future with the increasing complexity of the industry.

Earnings and Working Conditions

The earnings of production workers in this industry are generally higher than those in other manufacturing industries. In April 1959, production workers employed in the automobile industry earned, on the average, $111.49 a week or $2.68 an hour. This compares with the average earnings of $89.87 a week or $2.23 an hour for production workers in all manufacturing industries in the same month.

The accompanying tables of earnings in assembly plants and automobile parts plants, based

TABLE 1. *Average straight-time hourly earnings in selected occupations, automobile assembly (passenger) plants, United States and selected areas, July 1957* [1]

Occupation	United States	Michigan	North Central States [2] (except Michigan)	Remainder of United States
Maintenance				
Carpenters, maintenance	$2.74	$2.75	$2.72	$2.72
Electricians, maintenance	2.81	2.82	2.78	2.80
Machine, repairmen	2.85	2.86	2.83	2.80
Millwrights	2.76	2.77	2.74	2.71
Pipefitters, maintenance	2.76	2.77	2.74	2.74
Sheet-metal workers, maintenance (tinsmiths)	2.75	2.74	2.75	2.75
Toolroom				
Machine tool operators, toolroom	2.82	2.83	2.80	2.79
Patternmakers, metal	3.42	3.42	3.41	3.44
Patternmakers, wood	3.37	3.38	3.34	3.41
Tool and die makers	2.95	2.96	2.92	2.91
Custodial and material handling				
Checkers, receiving and shipping	2.25	2.23	2.26	2.27
Janitors, porters, or cleaners	2.07	2.07	2.07	2.05
Laborers, material handling	2.17	2.18	2.17	2.17
Truckers, power	2.23	2.23	2.24	2.24
Other selected occupations				
Assemblers, line and bench	2.27	2.27	2.27	2.27
Inspectors, general production	2.31	2.30	2.33	2.32
Machine tool operators:				
Bar stock screw machine operators	2.42	2.44	2.39	2.31
Crankshaft grinders	2.36	2.36	2.47	2.31
Machine tool operators, production, other	2.28	2.29	2.29	2.24
Metal finishers	2.40	2.41	2.40	2.39
Molders, machine	2.38	2.37	2.39	2.43
Punch press operators	2.30	2.29	2.31	2.34
Sewing machine operators	2.18	2.19	2.13	2.30
Sprayers, body, fenders, and hood	2.39	2.40	2.40	2.38
Trimmers	2.34	2.37	2.34	2.32
Welders, hand	2.39	2.39	2.39	2.39
Welders, machine (resistance)	2.31	2.29	2.32	2.33

[1] It should be noted that between July 1957 and late 1958, average hourly earnings of production workers in the automobile industry were increased 9 cents to reflect a cost of living increase and 7 cents as an annual improvement factor. In addition, maintenance workers and other skilled workers received another 8 cent increase.

[2] Includes data for Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics.

upon a wage study made by the Bureau of Labor Statistics, shows the average straight-time hourly earnings of production workers in selected occupations in the automobile industry, by region, in July 1957.

More than 60 percent of the plant workers in automobile assembly plants had average straight-time hourly earnings between $2.20 and $2.40 an hour in mid-1957. Skilled workers in maintenance and toolroom jobs in assembly plants averaged more than $2.70 an hour in July 1957.

Workers employed in parts plants located in Detroit generally had higher average straight-time hourly earnings than workers employed elsewhere. (See table 2.) The starting rate for unskilled workers in Detroit in July 1957 was $1.70 or more an hour.

As a result of collective bargaining contracts negotiated between employees and unions, most employees in the industry receive benefits such as life insurance, accidental death and dismemberment benefits, weekly accident and sickness benefits for temporary disability, and hospitalization, surgical, and medical benefits. These are financed by employers or jointly by employers and employees. Most workers also are covered by supplemental unemployment benefit plans (paid for solely by the employers). These plans provide cash payments ranging from $2 to $30 a week to all hourly rated employees with at least 1 year of service. These benefits are in addition to those received from State unemployment compensation plans. Most employees also receive paid vacations (or payments in lieu of vacations) ranging from 1 to 3 weeks and an average of 7 paid holidays a year.

A great majority of the automobile workers are covered by pension programs, almost all of which

TABLE 2. *Average straight-time hourly earnings in selected occupations, automobile parts plants, United States and selected areas, July 1957*

Occupation and grade	United States	Northeast [1]	North Central [2]		
			Total	Detroit	Other than Detroit
Assemblers, class A	$2.54	$2.24	$2.75		$2.75
Carpenters, maintenance	2.51	2.48	2.54	$2.69	2.50
Checkers, receiving and shipping	2.09	2.00	2.14	2.24	2.12
Electricians, maintenance	2.66	2.63	2.67	2.81	2.64
Inspectors, class A	2.42	2.44	2.42	2.73	2.40
Janitors, porters, or cleaners	1.93	1.86	1.95	2.06	1.93
Laborers, material handling	1.98	1.95	1.99	2.14	1.95
Machine repairmen	2.63	2.48	2.66	2.82	2.61
Machine tool operators, production, class A	2.67	2.40	2.71	2.74	2.70
Machine tool operators, production, class B	2.45	2.31	2.49	2.40	2.50
Machine tool operators, production, class C	2.21	2.08	2.25	2.25	2.25
Machine tool operators, toolroom	2.67	2.47	2.75	2.95	2.68
Metal finishers	2.30		2.30		2.08
Millwrights	2.60	2.58	2.61	2.76	2.58
Molders, machine	2.55	2.67	2.54	2.42	2.58
Patternmakers, metal	2.95		3.01	3.06	2.97
Patternmakers, wood	2.96	3.01	2.82		2.78
Pipefitters, maintenance	2.64	2.62	2.64	2.78	2.61
Polishing and buffing machine operators	2.46	2.29	2.47	2.50	2.46
Punch press operators, light or medium	2.13	2.14	2.15	2.25	2.11
Punch press operators, heavy (double crank or toggle)	2.48	2.66	2.42	2.44	2.40
Sheet-metal workers, maintenance (tinsmiths)	2.64	2.66	2.64	2.78	2.62
Tool and die makers	2.83	2.67	2.88	3.06	2.84
Truckers, power	2.11	2.08	2.12	2.21	2.09
Welders, hand	2.53	2.49	2.54	2.77	2.43
Welders, machine (resistance)	2.20	2.19	2.21	2.25	2.19

[1] Includes data for Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[2] Includes data for Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
SOURCE: U.S. Department of Labor, Bureau of Labor Statistics.

are paid for entirely by the employer. Retirement benefits vary with length of service. In a typical case, a retiring employee, age 65, with 30 years' service, receives a monthly company pension of $72 in addition to his Federal social security benefits.

The great bulk of the production workers in the automobile assembly plants and a majority employed in parts plants belong to the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America. In some automobile parts plants, the International Union Allied Industrial Workers of America is the bargaining agent for employees. Other unions with membership in the automobile industry include the International Association of Machinists; the Pattern Makers' League of North America; the International Molders and Foundry Workers Union of North America; the Metal Polishers, Buffers, Platers and Helpers International Union; and the Mechanics Educational Society of America, the International Brotherhood of Electrical Workers; and the International Die Sinkers Conference (Ind.).

In general, the work surroundings in automobile plants are more favorable than those in most types of metalworking facilities. Most of the places in which automobile workers are employed are relatively clean and free from dust, smoke, and fumes. However, some work surroundings, particularly in the foundry and forge departments, may be hot and the worker may be exposed to noise, dust, and fumes. In recent years, the working conditions in foundries and forge departments have been greatly improved by the introduction of larger and better ventilation systems than were previously used.

Automobile plants are, on the whole, comparatively safe places to work, although safety conditions vary somewhat among the individual departments or facilities. The average number of disabling injuries in automobile assembly plants was less than half as much as for all manufacturing industries in 1957. In that year, the average number of disabling injuries was 6.1 in the parts industry for each million employee hours worked, compared with an average of 11.4 for all manufacturing industries. Many automobile plants have fully equipped hospital facilities with doctors and nurses in attendance.

OCCUPATIONS IN THE BAKING INDUSTRY

Until fairly recent times, the commercial baking business was made up of small shopowners whose methods of baking bread were little different from those of the Romans. Scientific baking developed late in the 19th century with Pasteur's discovery of the nature of fermentation. The rapid industrialization and the social changes of the past century have established baking as one of our major manufacturing industries. Small bakeshops are still found in many neighborhoods, but the vast bulk of bakery products consumed by the American people are made in modern factory-type bakeries using advanced methods and equipment. More than one quarter million men and women are employed by baking firms to make bakery products and to distribute them to thousands of retail stores, homes, and restaurants. Instead of the combination craftsman-shopowner of former times who had perhaps a helper or two, today's bakery may employ specialized workers with a wide range of skills.

The baking industry employs people with varied interests and talents. For those who like to use their hands as well as their minds, it provides hundreds of opportunities each year to learn a skilled trade as an all-round baker or as a skilled specialist in the baking process. For those who like to meet people and to sell, it offers jobs as driver-salesmen and sales supervisors. For the mechanically inclined, the industry has openings for persons to maintain and repair the increasing amount of machinery and equipment used in today's modern bakery. For those who like to work in an office, there are the usual types of clerical jobs. Many administrative and managerial specialists are also employed to direct the operations of hundreds of large baking firms throughout the Nation.

Nature and Location of the Industry

Baked foods are made by different kinds of baking firms. For example, there are large wholesale or chain store bakeries, which employ more than half of the industry's workers. In addition, several hundred bakeries produce goods which they sell by delivering them to the homes of their customers. Neighborhood shops make cakes, pies, and other baked foods on their own premises and sell them to local customers. Some baked foods are made in central bakeries having a number of retail outlets. The bread and pies served in restaurants are usually made in one of the many bakeries specializing in sales to hotels, restaurants, and institutions.

The baking industry, with more than a quarter million employees, ranks well up in size among manufacturing industries. It employs more people than any other food industry. During the late 1950's, the industry's 6,000 industrial bakery establishments annually produced more than $3 billion worth of bread, cakes, doughnuts, pies, rolls, and other bakery products. In addition, 12,000 single-shop retail bakeries which bake on the premises employed approximately 75,000 persons and had annual sales of about $700 million in the late 1950's.

Because baked foods are perishable and must be delivered soon after they are made, almost every sizable town has at least one bakery to serve the needs of the community. This is important to a young person considering a career in the baking industry, because it means that there are job opportunities in his own community; also, after he has gained experience, he may be able to get a baking job in almost any part of the country.

Bakeries are located in all parts of the country in approximate relation to the distribution of the Nation's population. The 10 States, accounting for about three-fifths of the Nation's population, also account for about three-fifths of the baking industry's workers.

Generally, baking plants are small as industrial plants go, but there are many large bakeries. Of the more than 6,000 establishments in the industrial baking industry in 1954, 9 employed more than 1,000 workers each, and 33 employed 500 to 1,000. Together, these 42 bakeries employed about 14 percent of the industry's workers. Many of the 6,000 plants are owned by large wholesale baking companies whose operations cover several States. On the other hand, more than half of the plants had less than 10 employees each in 1954. Together, these small plants employed less than

Dough mixer releasing a batch of dough into trough prior to first proofing.

6 percent of the industry's total. The nature of the market accounts for most of the variation in size of baking plants. Some bakeries with fleets of trucks serve markets up to 75 or 100 miles distant, but most industrial bakeries serve only their own community or in some cases only a particular neighborhood.

Occupations in the Baking Industry

Anyone interested in a career in the baking industry will want to know about the variety of job opportunities which it offers. One of the many interesting production jobs may appeal to some young persons. Those who enjoy meeting the public may find work as driver-salesmen attractive. There are also many opportunities in administrative positions for persons with a flair for organizing and directing the work of others and who have the necessary educational background. Many baking jobs are open to women, who make up about 20 percent of the industry's work force.

The largest group of employees is made up of those who perform actual baking operations and those who receive and store raw materials and maintain and repair plant machinery and equipment. Altogether, this group accounts for about three-fifths of the industry's total employment. Sales personnel, including wholesale drivers, routemen delivering directly to homes, and sales supervisors—of key importance to the success of a baking firm—make up about one-fourth of the work force, a very high proportion for a manufacturing industry. The remaining one-sixth of the employees are in administrative, supervisory, professional, or clerical jobs.

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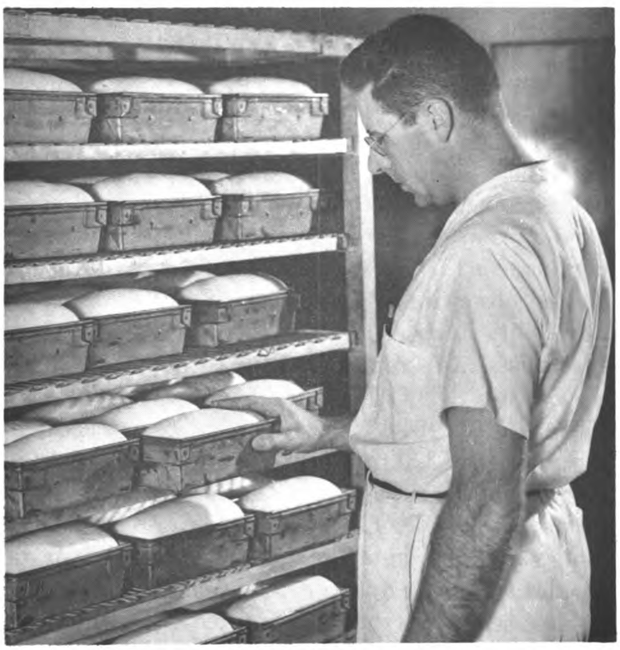
Some of the important occupations in the baking industry are described in more detail below.

Production Occupations. Because of the limited quantities produced in small bakeries, *all-round bakers* (D.O.T. 4-01.100-.800), assisted by helpers, usually perform most of the baking operations. Even in large bakeries, however, because of the great variety of products, the baking process is difficult to divide into specialized tasks. Consequently, in these plants, all-round bakers also carry through all the steps needed to turn out a finished product. Larger bakeries employ all-round bakers as working foremen who are responsible for a particular phase of production, such as mixing or preparing dough for baking. They must be able to handle the process of which they are in charge as well as assume responsibility for the efficient functioning of both the men and machines in their department. Moreover, they must coordinate the work of their department with production schedules of other departments.

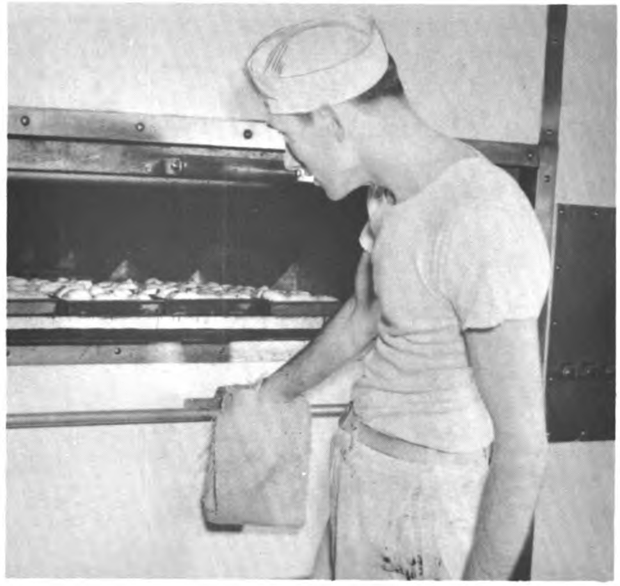
In addition to all-round bakers, large bakeries also employ many persons who specialize in a particular baking operation. Although many of these specialists are qualified to do all or a number of baking operations, they generally spend all their time on one phase of the process. These workers perform such tasks as feeding and unloading machines, observing their operation, and visually or physically inspecting the output. Among these specialists are *mixers* (D.O.T. 4-01.600-.700), *dividermen* (D.O.T. 6-02.123), and *moldermen* (D.O.T. 6-02.124) who operate machines used in the process of baking. Other baking specialists in large firms include bench hands and ovenmen. *Bench hands* (D.O.T. 4-01.200) knead and form dough by hand into fancy shaped rolls, bread, or cookies which cannot be made under a mechanized process and place the dough in pans ready for the oven. *Ovenmen* (D.O.T. 4-01.800) control the baking of rolls, bread, cakes, and other baked products by regulating the baking time, heat, and humidity of the oven, guided either by a fixed schedule or by watching the physical appearance of the baking food.

A considerable number of helpers are employed in baking operations. As their name implies, they assist the skilled specialists who carry out certain production processes. They have such titles as dough mixer helper, bench hand helper, and ovenman helper. Helpers also perform such jobs as greasing pans, removing bread from plans, pushing troughs and racks, and washing pans.

Other production and related occupations. In addition to skilled baking specialists and their helpers who perform the actual baking operations, large bakeries employ other workers to put the finishing touches on baked foods. Those which specialize in "sweet goods," employ a considerable number of people in their icing departments. *Icing mixers* (D.O.T. 4–02.321) prepare cake icings and fillings in accordance with prepared recipes. They weigh and measure ingredients, mix ingredients by machine, and prepare cooked fillings by placing ingredients in a kettle and controlling the heating and blending process. *Hand icers* (D.O.T. 4–02.311 and 6–02.311) and *machine icers* (D.O.T. 6–02.331) cover baked cakes and pastries with icing or frosting either by hand or



Baker examining bread dough to see if it is ready for the oven.



PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Ovenman checking the physical appearance of rolls to see if they are done.

by machine, depending on the type of product and the amount of mechanization of the plant. *Slicing machine operators* (D.O.T. 6–02.420) and *wrapping machine operators* (D.O.T. 6–02.430) complete the final operations in breadmaking. These workers feed and unload the wrapping or slicing machines and are responsible for their proper adjustment and operation. Bakeries employ many persons in their storage, warehousing, and shipping units. Receiving and stock clerks check and keep records of incoming supplies and ingredients used in making baked foods and deliver them to various departments. Packers and checkers make up orders of bakery products for driver-salesmen.

Maintenance Occupations. Several thousand skilled workers and their helpers are employed by bakery firms to keep the machinery and equipment in repair. Small- and medium-sized plants employ mechanics to do general repair work on all types of equipment in the plant. These workers must be skilled in several trades rather than specialists in one trade or type of maintenance work. Their work involves checking machinery and mechanical or electrical equipment, diagnosing source of trouble, dismantling machinery or equipment, and making necessary repairs. Large plants generally employ maintenance workers who are skilled in a particular specialty. Included are electricians, stationary engineers, machinists, and maintenance mechanics. The largest group of maintenance workers are skilled automobile mechanics who are needed to keep the estimated 75,000 motor vehicles owned by baking firms in good repair. (Detailed discussions of the duties, training, and employment outlook for these maintenance occupations appear elsewhere in this Handbook. See index for page numbers.)

Sales Occupations. Getting finished bakery products to grocers' shelves, to restaurants, or to homes provides jobs for about one-fourth of the industry's workers. The driver-salesman or routeman who sells primarily to grocery stores delivers wrapped bread and other baked foods to stores on his route. Before the driver starts out on his daily rounds, he checks his truck which has been loaded with baked foods. He starts his route early in the morning stopping at from 10 to 50 grocery outlets. At each of these stops, the driver-salesman brings bread and other baked products into the store and arranges them on the display rack assigned to his company. He may call back several times a day at some busy stores to restock the shelves. He makes an accounting to the grocery storeowner or manager for the merchandise left, credits the store for unsold baked foods picked up, and collects for the products delivered. By midafternoon, the driver returns to the bakery to check in with the cashier and to return leftover goods. He also makes up a list of products he plans to deliver the next day. This list represents his best estimate of baked foods that will be sold by the grocery stores on his route. The production manager of the plant assembles these estimates from all the routes and makes up the production schedule for the next morning. One route supervisor may be in charge of all the driver-salesmen in a small bakery. Large bakeries generally have several route supervisors, each in charge of a group of 6 to 10 driver-salesmen. When one of the men is absent, the supervisor takes over the route until the salesman returns or is replaced. The route supervisor also trains new driver-salesmen and makes suggestions for increasing sales.

The driver-salesman who distributes bakery products directly to the home makes regular calls on the customers along his route several times a week, making as many as 200 to 300 stops a day. His truck is filled with a line of baked foods representing his best estimate of what housewives will buy that day. The driver-salesman makes deliveries directly to the door with a basket of bread, rolls, cakes, and pies from which a housewife can make her selection.

Generally, chain grocery store bakeries or multiretail outlet bakeries employ truckdrivers rather than driver-salesmen. These employees drive large vans to deliver baked foods one or more times a day to each of the company's stores. In those bakeries which operate their own retail outlets, unwrapped baked foods are carted from the van to the store in enclosed metal racks on wheels. In this way, a large assortment of fragile bakery products can be delivered to the display cases of retail stores just as if they had been baked on the premises. Sales clerks in the retail bakery arrange the display of the fresh-baked foods, aid customers in selection, and wrap purchases. Truckdrivers for chain store bakeries deliver bread and other bakery products (usually already wrapped) to the loading platform of individual stores. The display and stocking of baked foods in chain stores are done by store clerks. (Detailed descriptions of the duties, training, and employment outlook for truckdrivers and sales clerks appear elsewhere in this Handbook. See index for page numbers.)

Administrative, Clerical, and Technical Occupations. About one-sixth of the industry's work force is employed in administrative and managerial jobs and in office occupations. Business management of bakeries can be grouped in several broad classes. General administrators and proprietors of small firms are responsible for coordinating all aspects of baking activities—the purchase of raw materials and the production and delivery of baked products. Plant managers, comptrollers, sales managers, and other executives direct individual departments or special functions of a large firm. Other administrative employees help to carry on the business operations of running a bakery. They may specialize in such techniques as accounting, purchasing, advertising, and personnel and industrial relations. Business offices of bakeries employ many types of officeworkers, including bookkeepers, cashiers, clerks, business-machine operators, stenographers, typists, and switchboard operators. A large percentage of officeworkers are women. Some of the larger companies have laboratories which employ chemists, home economists, and technicians to test ingredients and to prepare formulas and recipes for bread and other baked items. (Detailed discussions of the duties, training, and employment outlook for technical, administrative, and office personnel appear elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

The different levels of qualification and kinds of training required for jobs in the baking industry reflect the wide range of skills and knowledge needed to operate this basic industry. Training requirements range from a few days of on-the-job training to several years of preparation. For example, some bakery workers, such as slicing machine operators, can be trained on the job in a few days. Skilled workers, such as bakers and baking specialists, require at least 3 or 4 years of training. Some administrative personnel must have a college degree or equivalent in their particular specialty.

Production Occupations. New workers for production jobs are usually hired as helpers or laborers. Most of their training is given on the job. In many bakeries, all-round bakers and baking specialists learn their jobs through formal apprenticeship. Apprentices are generally selected from among the helpers in a plant. Employers usually require that apprentices be between 16 and 26 years of age, have a high school or trade school education, have considerable manual dexterity, and show an interest in baking. The apprenticeship generally lasts 3 or 4 years and includes training in different operations in the baking process. In addition to on-the-job training, classroom instruction in subjects related to the trade may be given either in public or private vocational schools or in the plant.

Some helpers are able to learn the work of baking specialists and even that of all-round bakers without an apprenticeship by spending several years observing and working with skilled bakers. One can also learn baking in vocational schools or in the Armed Forces. This type of training in itself will not qualify a person as a skilled baker, but it may help a young person obtain a baker's apprenticeship and may also shorten the apprenticeship period.

Bakers may be promoted to foremen, production managers, and eventually to plant superintendents. All-round bakers with some business ability sometimes open up their own retail bakeries.

Maintenance Occupations. Maintenance workers, such as machinists, electricians, and auto mechanics who have acquired their skills in other employment or training, are sometimes hired directly by baking firms. However, many bakeries conduct some type of apprentice training to meet the needs of their maintenance shops. Other plants hire new workers as helpers to skilled maintenance employees. After gaining experience and knowhow while working with the skilled mechanics, these men are able to become skilled mechanics.

Sales Occupations. Persons with no previous sales training are often hired for jobs as driver-salesmen. Many firms prefer high school graduates with a pleasant appearance and with ability to meet and talk with people. Some large employers give aptitude tests to prospective employees to check for these qualities. Often, inexperienced workers are hired as stock clerks, packers, or checkers and are promoted to driver-salesmen as vacancies occur. A new driver-salesman may first be given classroom instruction in general sales, display, and delivery procedures. Most of the training, however, is done on the job by route supervisors. Driver-salesmen may eventually be promoted to route supervisors and sales managers.

Administrative, Clerical, and Technical Occupations. Young persons who have completed a commercial course in high school, junior college, or a business school are usually preferred for openings as secretaries, stenographers, typists, bookkeepers, and business machine operators.

Training and other qualifications for managerial personnel vary considerably among baking establishments. The responsibilities of managers of small firms are obviously quite different from those of officials of large corporations. Generally, jobs at the managerial level are filled by upgrading personnel already employed in the industry. Many of the proprietors and production managers of small companies have risen from the ranks of baking craftsmen. Some of the executives in small and medium-size plants have come up from the lower graded office jobs. Many branch managers of multifirm bakeries have started their bakery careers in the sales department.

In recent years, increasing numbers of college-trained persons, especially those with degrees in business administration, are being employed in the business offices of baking firms. Some companies look to these young college graduates as their future executives. Many of these persons have specialized in a particular administrative field such as marketing, accounting and finance, labor relations, personnel, or advertising. Several colleges offer courses in baking science and management; one college offers a 4-year course in this field. The curriculum includes courses in the principles of business administration as well as the scientific, technical, and practical phases of baking.

Employment Outlook

Continued expansion in the baking industry is expected in the 1960's. Additional workers will be employed to help produce and distribute the large quantity of baked foods that will be needed to feed our rapidly growing population. Because of the industry's constantly improving technology, increases in employment will be much less than those in the volume of business. However, many job opportunities for new workers will arise from replacement needs.

As we look at the industry's record of past growth, the underlying trends that will bring about its future expansion become clear. The baking industry has had a long history of rising employment. In the past century, employment rose from less than 10,000 in 1850 to almost 327,000 by 1958. During this period, in terms of number of employees, the industry changed from a local neighborhood hand work activity to a highly mechanized industry serving large urban areas. The growth of population, the movement from farm to cities, the rise in income, and the greater number of women employed outside the home produced a greater demand for factory-baked products. Improved transportation also enabled the industry to distribute its products to mass markets.

Although employment in the industry is expected to rise, it will grow less rapidly than bakery output. Continued mechanization of baking operations and the trend toward large plants will result in the production of more baked foods per plant worker. Greater use of bulk handling of raw materials, larger and more automatic processing equipment, more automatic instrument control of weighing ingredients, and further installation of conveyors to carry bakery products from one process to the next is expected to continue.

Some innovations now on the horizon may also affect employment in this industry. Freezing, rapid defrosting, and the automatic forming of dough by forcing it under pressure through preset forms (extrusion) may prove to be economically advantageous and enable bakeries to mass-produce and stockpile their products. Freezing, for example, would enable bakeries to prepare a week-or-more supply of pastries and cakes instead of operating on a day-to-day basis. This would result in a more efficient use of mixing machinery with less downtime for cleaning between each batter mixing. Still in the development stage are processes that make certain basic production operations automatic. Included among these are a process in breadmaking that eliminates the sponge (raised dough) step in dough-mixing and another that involves the continuous mixing of cake batters.

These technological changes affect not only the number of plant employees but also the kind of jobs they do. For example, machines have, to a large extent, replaced hand work in industrial baking establishments, particularly in strenuous work as materials handling. In the future, a larger proportion of production workers will be bakers or baking specialists with fewer helpers and laborers. This, of course, improves job opportunities in the higher skilled, better paying jobs.

Many job opportunities for new workers will arise from replacement needs which, in a field of employment as large as this, are very substantial. About 4,000 or 5,000 bakery workers will retire or die each year and others will transfer to different fields of work.

The baking industry, because it is so vital to our daily living, offers a degree of job stability not found in many other industries. The industry is affected less by business cycles than most other industries. It generally offers steady, year-round employment. Since the industry is widespread, opportunities to enter the industry are available in every community.

Earnings and Working Conditions

Although earnings of bakery workers vary greatly from area to area, they compare favorably with those of other industrial workers in the same community. In general, the larger the city, the higher the wage rate. Wage rates tend to be higher in the Far West and Northeast than in the South or Southwest.

Weekly earnings of working foremen and all-round bakers in early 1957 typically ranged from $80 to $110 for a 40-hour week. Baking specialists were earning from $1.75 to $2.50 an hour. Apprentices usually start at about 50 percent of the journeyman (skilled worker) rate. In the course of the training, their wages are periodically increased about every 6 months, so that at the end of their apprenticeship they receive the journeyman's rate.

Driver-salesmen are usually paid on a commission basis, often with a base pay plus a percentage of total sales. Generally, driver-salesmen have a guaranteed minimum salary. In early 1957, weekly earnings for experienced driver-salesmen generally ranged from $80 to $135 with those having the "choice" routes making considerably more.

Baking is done around the clock in many plants and many plant employees work night shifts and Sundays. Workers receive extra pay for working nights. Night-shift differentials generally range from 5 to 15 cents an hour. Most plant workers are on a 40-hour week although some work 44 or 48 hours regularly. Time and a half is paid for work over 40 hours a week.

The kind of working conditions an employee has depends, of course, on the type of job. Driver-salesmen on house-to-house routes work both indoors and outdoors. Driver-salesmen delivering to chain stores and other grocery stores spend much of their time arranging baked foods on the display racks. Despite the considerable mechanization in the baking process, many of the jobs require some strenuous work. Work near ovens may be unpleasantly hot. Administrative and other officeworkers are in business offices similar to those of most business concerns. They generally have pleasant working surroundings.

Paid vacations for employees are almost universal in industrial baking firms. Vacation periods range from 1 to 3 weeks, according to length of service. Most baking firms have adopted some type of insurance or pension arrangement for their employees. Some provide life insurance plans; others have health insurance programs or retirement and pension plans. A large number of employees are covered by joint union-industry health and welfare plans and pension systems which are paid for entirely by employer contributions.

Most plant workers and drivers belong to a labor union. Wage rates, hours of work, vacations, and other matters affecting jobs are for the most part established by collective bargaining between baking firms and unions. Most bakers, baking specialists, and other plant workers are members of the American Bakery and Confectionery Workers' International Union or the Bakery and Confectionery Workers' International Union of America (Ind.). Driver-salesmen and transport drivers are generally members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America. Some maintenance workers are members of craft unions such as International Association of Machinists and the International Union of Operating Engineers.

Where To Go for More Information

Information on jobs in the baking industry may be obtained directly from the personnel department in a local bakery.

High school students—or adults interested in evening courses—may obtain information on courses relating to baking by writing to the Director of Vocational Education or to the Superintendent of Schools in their local community; or to the State Director of Vocational Education in the Department of Education in the State capital.

General information on opportunities in the baking industry and on requirements for entering accredited schools which offer courses or degrees in baking science and technology may be obtained by writing to:

American Bakers Association,
20 N. Wacker Drive, Chicago 6, Ill.

BANKING OCCUPATIONS

More than 600,000 people were employed in 1958 in the Nation's banks, which give many kinds of financial services to businessmen and other individuals and organizations. Nearly all businessmen and great numbers of other people maintain accounts with banks, in order to earn interest on their money, insure its safekeeping, and pay bills more conveniently. Many also obtain loans from banks, rent safe deposit boxes in their vaults, or rely on banks for other kinds of help—such as the administration of estates and trusts, analysis and handling of securities, and foreign banking operations. The complicated financial transactions of our present day business world could not be carried on without banking services.

Nature of the Banking Business

Though several types of banks are found in most cities today, commercial banks, which offer the most varied services, lead in numbers and employment. About 13,500 commercial banks, with approximately 8,000 branches, were operating at the beginning of 1958. Together, these 21,500 banking offices employed more than half a million workers, about half of whom were women. Mutual savings banks are another type of bank offering some of the services of commercial banks. These banks handle savings deposit accounts, and may also furnish safe deposit facilities and administer trusts.

Many other financial institutions employ workers with the same occupational skills required in banks. Among these institutions are savings and loan associations, which usually invest customers' funds in first mortgage loans made on real estate; personal finance companies, which specialize in consumer credit; and investment banking organizations which underwrite, buy, and sell corporation stocks and bonds and municipal bonds. Some government or government-related agencies also have positions of a banking nature; among these are the housing and farm financing agencies, the Export-Import Bank, the Federal Deposit Insurance Corporation, and the Federal Reserve System. Federal Reserve Banks, operating as bankers' banks in 12 districts, had about 20,000 employees in 1958. The Federal and State agencies concerned with the supervision of banks employed about 3,000 persons as bank examiners.

Banking involves a mammoth amount of clerical work. Approximately two-thirds of all bank employees are clerical workers who handle checks and deposits, keep records of transactions, and take care of correspondence, telephone calls, and other office duties. (See chart 35.) The Nation's commercial banks handle over 10 billion checks a year for more than 100 million depositors. The clerks who sort, record, file, mail, and otherwise process these checks make up one of the largest groups of bank clerks. Some of them operate proof machines, computers, and other machines designed especially for banks; others operate office machines, such as adding or calculating machines, which are used in many types of offices. Two other large groups of clerical employees are bookkeepers, and secretaries, stenographers, and typists. The skills of many of these workers are, of course, the same as those required for similar work in other industries. (See statements on bookkeepers, p. 228; office machine operators, p. 230; and on secretaries, stenographers, and typists, p. 234.) Tellers are a large group unique to banking. Other workers in the clerical category include credit analysts, loan examiners, telephone operators, and messengers.

Bank officers—presidents, vice presidents, treasurers, comptrollers, cashiers, and assistants—are the people directly responsible for the management of banks. About one-sixth of all bank employees are officers. In addition, various professional specialists, such as accountants, lawyers, statisticians, economists, and engineers (see index for page numbers of statements on these occupations), may be employed full or part time to give expert advice, conduct research, and prepare reports.

Where Employed

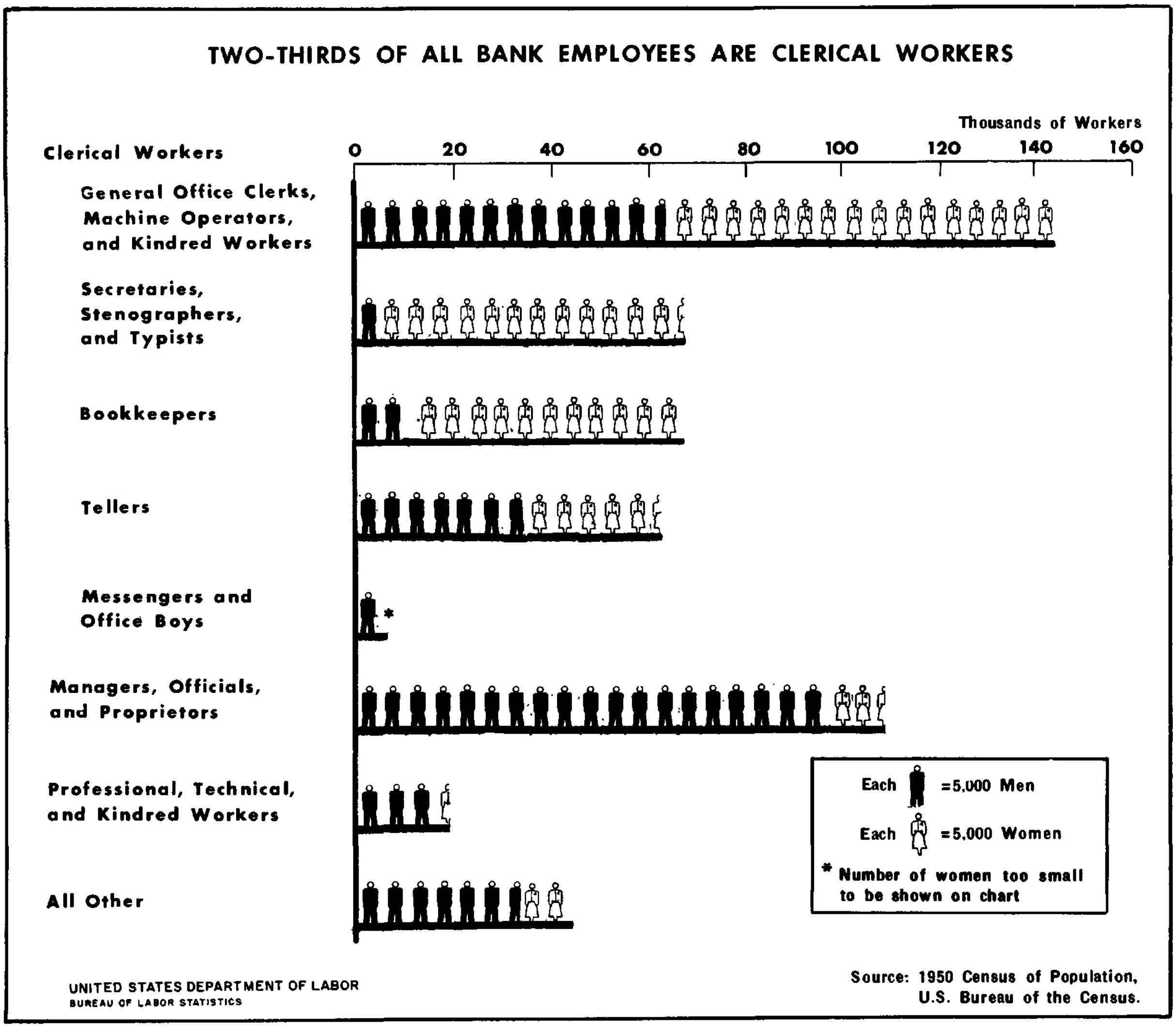
Most cities and towns in the United States have one or more banks. However, approximately 40 percent of the employees of insured commercial banks are in New York, California, Pennsylvania, and Illinois, the States with the largest population. The more than 500 mutual savings banks and their workers are located chiefly in the Northeastern States. There are far more bank employees in New York City, the financial capital of the Nation, than in any other city.

Banking employment is also concentrated to a considerable extent in the relatively small number of very large banks. In early 1958, about half of all bank workers were employed by the 244 largest institutions, which represented less than 2 percent of all insured commercial banks. These large banks each had $100 million or more in deposits and an average work force of more than 1,000. In contrast, the 8,600 smallest banks, each with less than $5 million in deposits, averaged only 8 employees per bank. These small banks represented about two-thirds of all insured commercial banks.

Employment Outlook

Job opportunities in banks are expected to be numerous during the early 1960's. Most openings will be in clerical occupations, which are filled mainly by women. In these occupations, as in others employing large numbers of women, many vacancies arise as women leave to marry or for other reasons. Most of the openings in banks—

CHART 35



probably more than 100,000 annually—will result from the need to replace persons who resign, retire, or leave bank employment for other reasons. In addition, some people will be hired to fill new clerical positions, especially those positions resulting from the more widespread use of electronic data-processing machines in banks. A number of opportunities will also arise for young college graduates to begin in trainee jobs which may eventually lead to officer positions. There will also be some openings for professional and specialized personnel, including lawyers, accountants, programmers, and personnel workers.

Employment in banks has increased steadily over a long period, but the greatest expansion has occurred in the last 10 years. The total number of bank employees was about 1½ times greater in 1957 than in 1947; insured commercial banks, the largest employers, added about 19,000 new jobs per year, on the average, during this period. Major factors responsible for the expansion of bank employment have been the rising levels of production, sales, and income in this country and the resulting extensive use of bank services by businessmen and consumers. As population and income have grown, banks have also expanded their services—especially those, such as small loans and economy checking accounts, for people with moderate incomes.

Most of the job openings created by the growth in banking business or by turnover will continue to arise in large city banks, which account for the bulk of bank employment. However, branch banks will offer many opportunities in small communities. Branch banking—which has increased steadily since the midthirties—will continue to expand as people move to suburban areas of large cities and new business centers are established to serve these communities.

More jobs will also arise as established banks expand their services to old customers and seek new business. Banks will probably continue to build "auto bank" branches and "drive-up" facilities to help customers with parking problems. Pension funds, especially the growing number established under union-management agreements, will continue to be an important source of new business for banks' trust and investment services. Development credit corporations, to which banks and other financial institutions supply funds for loans to businessmen and others, will probably continue their growth. Some large banks are expanding their services in such areas as bookkeeping for business firms, and the handling of charge accounts for retail stores.

The major growth factors already discussed point to a continuing increase in banking employment in the long run. Employment growth will be limited to some extent by the use of additional and improved automatic office equipment. In the future, more and more checks will be automatically handled and processed by electronic machines. Nevertheless, it is likely that total banking employment will continue to rise. The effect of new office machine developments, particularly the use of electronic computers, will vary from one occupation to another, as discussed in the statements on specific occupations in banking which follow this section on the banking industry as a whole.

Besides looking forward to continued long-term growth in their industry, bank employees can anticipate greater stability of employment than workers in many other fields. In general, they have been less affected by layoffs during declines in the general level of business activity than workers in some other industries. Since individual bank deposits are insured up to $10,000, it is unlikely that there could be a recurrence of mass closings of insolvent banks such as occurred in the early 1930's. Employees are not likely to lose their jobs when banks are sold, merged, or consolidated, as these establishments usually continue to do business as branch banks. If bank employers have to curtail employment for various reasons, they can usually do so by not replacing employees who retire, die, or quit their jobs for other reasons, thus reducing the number of openings for new employees, but minimizing layoffs of experienced personnel.

Earnings and Working Conditions

Women in beginning clerical jobs, such as office girl and file clerk, in banks, insurance companies and related businesses had average weekly earnings ranging from $43 to $55 in 13 large cities surveyed in 1957–58 by the Bureau of Labor Statistics. Beginning typists had average salaries ranging from $46 to $59 a week in all of the cities surveyed; more experienced typists from $54 to $68. Secretaries were usually the highest paid women clerical workers in the nonsupervisory jobs surveyed, averaging $70 to $84 a week. Men accounting clerks were the highest paid of all the groups surveyed, with average weekly salaries between $80 and $90 in most of the 13 cities. For most groups of clerical workers, pay levels were found to be highest in Chicago, Cleveland, New York City, and the San Francisco-Oakland and Los Angeles–Long Beach areas.

Tellers, who are experienced employees and among the highest paid clerical workers in banks, were not covered by this survey. Salaries in this occupation usually depend on the responsibility and knowledge required for specific jobs. For example, tellers handling special Christmas club accounts are among the lowest paid in the occupation; regular savings account tellers usually have somewhat higher earnings, and paying and receiving tellers make still more. Note tellers who compute interest on notes, handle collateral on loans, and do other highly responsible work receive even higher salaries. Senior and head tellers in large banks are the highest paid tellers.

College graduates hired as executive trainees in large banks in 1957 had annual average starting salaries ranging from about $3,900 to $4,500, depending on the size and geographic location of the bank (according to a private survey). Trainees hired 10 years earlier who had been promoted to officer positions earned, on the average, about $8,800 annually in banks with under $200 million in deposits, and approximately $10,500 in banks with over $200 million in deposits. Assistant vice presidents in large city banks generally earned between $12,000 and $20,000 in 1958; the vice presidents earned over $20,000.

Salaries of both officers and clerical workers are much lower in smalltown banks than in those in big cities. Average salaries of employees (excluding officers) working in the smallest commercial banks are approximately half those of employees in the largest banks. Officers in the smallest banks may receive only about one-third as much as those in the largest organizations. These differences are due to the greater responsibilities and more specialized nature of executive work in larger banks and to the fact that large banks are usually located in large cities where salary rates reflect the higher living expenses. In small towns, bank officers often have greater opportunity to supplement their incomes from sources such as insurance or real estate commissions.

In large cities, most employees in finance and related industries (banking, insurance, and real estate) work slightly less than the 40-hour week customary in many industries. In small banks, daily hours may be irregular. In many banks, tellers and some other employees may work late hours at least once a week, and accounting department employees may work overtime during end-of-month peak periods.

Banks are noted for their liberal provisions for holidays. Eleven or more paid holidays were common for employees in Northeastern States in early 1958. In contrast, manufacturing industries usually provided only 6 or 7 paid holidays annually. A 2-week vacation after 1 year's service is given by most banks. A number of banks allow a 3-week vacation after 10 or 15 years' service and 4 weeks after 20 or 25 years. Life insurance and hospitalization and surgical plans are benefits usually granted banking employees. Retirement plans, frequently financed by employer and employee contributions, are also common in banking.

Work in banks is generally carried on in clean, well-lighted, and often air-conditioned office space. In larger banks, most clerical employees work in offices not in the public view. Most clerical work in banks requires no strenuous physical exertion, and a number of jobs can be performed by moving about in a limited work area. This affords some opportunities for older men and women and for those with certain physical handicaps.

Where To Go for More Information

Information on jobs in banking may be obtained from your local bank and your State bankers association. General information on banking occupations is available from:

American Bankers Association,
12 East 36th St., New York 16, N.Y.

Information on in-service educational opportunities for bank employees is available from:

American Institute of Banking,
12 East 36th St., New York 16, N.Y.

Information on investment banking may be obtained from:

Investment Bankers Association of America,
425 13th St. NW., Washington 4, D.C.

For additional information on salaries of clerks in finance industries including banks, see:

Wages and Related Benefits, 19 Labor Markets, 1957–58, Bureau of Labor Statistics Bulletin 1224–20, 1959. Superintendent of Documents, Washington 25, D.C. Price 50 cents.

The following publication gives information on training requirements, earnings and working conditions, and the employment outlook for personnel in occupations connected with the electronic data-processing systems used in banks and other industries:

Automation and Employment Opportunities for Office Workers, Bureau of Labor Statistics Bulletin 1241, 1958. Superintendent of Documents, Washington 25, D.C. Price 15 cents.

Bank Clerks and Related Workers

Nature of Work

Many thousands of employees in banks are bookkeepers, office machine operators, messengers, or clerks who are assigned to specialized functions. The exact duties performed by these workers vary with the size of the bank and the nature of its business. In small banks, clerks may work at combination jobs such as messenger-clerk or proof-machine-bookkeeping-machine operator, or they may serve as general clerks who file material, operate the switchboard, give routine information to the public, operate duplicating or other office machines, and help with sorting and listing of checks and other items. In large banks, clerks are usually assigned to specific jobs such as those discussed below.

A *bookkeeping clerk* may cancel and file checks, sort and list various items, and alphabetize material for experienced bookkeepers. A *transit clerk* (D.O.T. 1–01.43; 1–06.21 and .22; 1–06.24) sorts checks and drafts on out-of-town banks according to routing instructions, lists sorted items on cash letters, and mails checks and cash letters for collection purposes. A *mortgage clerk* (D.O.T. 1–37.34) may type legal papers affecting title to real estate, record the transaction, and maintain a record card file.

Some of the office machines commonly used in banks are adding machines, proof (sorting) machines, and bookkeeping machines. Most check sorting is done by *proof machine operators* (D.O.T. 1–25.68). The proof machines have sort keys and adding machine keys which sort checks and record amounts involved in a single operation. Proof machine operators may also help prepare monthly statements of customers' accounts for mailing.

Bookkeeping machine operators are responsible for maintaining records of customers' accounts. The proof department forwards deposit slips and paid checks to the bookkeeping machine operator who arranges them in their proper order. Then, using the bookkeeping machine, the operator adds deposits and subtracts withdrawals from customers' accounts, usually kept on statement cards. The bookkeeping machine operator may also cancel and file checks, give information about accounts by telephone, and prepare customers' statements for mailing. In many banks, the title of bookkeeper is assigned to these workers and, in some cases, to bookkeeping clerks as well. Very few hand bookkeepers are employed in banks nowadays.

In large banks where many records may be kept on punch cards, clerks are employed as *key-punch operators* and *tabulating machine operators*. Operation of a microfilm machine to main-

Clerks operating new electronic machines posting bank records.

tain photographic records of checks may also be a separate job in some banks. One or more clerks may also operate Multilith, Mimeograph, or Addressograph machines.

Bank messengers (D.O.T. 1–06.27) are responsible for the safe delivery of banking items such as checks, drafts, and letters. They make trips to other banks, branches of the same bank, business firms, and often government agencies in the local area. Messengers in many banks are older men who, although still active, can do only light work. *Inside messengers* or pages, who may be men or women, run errands within the bank and may also do simple clerical tasks.

(For information on clerical jobs connected with the use of electronic data-processing machines, see statement on Office Machine Operators, p. 230.)

Training, Other Qualifications, and Advancement

High school graduation is adequate preparation for most clerical entry jobs in banks. For the majority of jobs, business education courses such as bookkeeping, shorthand, typing, and business arithmetic are considered desirable. In addition, since bookkeeping, adding, and calculating machines are widely used in banks, courses in machine operation are helpful. Before an applicant is hired, he is usually given a personal interview by at least one bank official and may be given an intelligence test and a clerical aptitude test—the latter to determine his speed and accuracy. Employers usually give favorable consideration to young people who have worked in a school bank or held a part-time bank job.

Young men and women without previous experience may be hired for many of the jobs already mentioned, such as file clerk, bookkeeping clerk, and transit clerk. Inexperienced people may also be hired and trained by the bank to operate proof, bookkeeping, and other office machines designed especially for use in banks. Whereas most new employees were formerly hired as messengers, now only a limited number of beginners are assigned to such work.

The line of promotion from a routine clerical job may be to a minor supervisory position, next to teller or analyst, and then to a senior supervisory positon. Some opportunities for advancement to bank officer also exist for outstanding employees, although an increasing number of banks give preference to persons with college training in selecting officers. Additional education obtained while employed, particularly the completion of courses offered by the American Institute of Banking, may be helpful in advancement. Since most banks follow a "promotion-from-within" policy, length of service is also an important factor in advancement.

Employment Outlook

Openings for clerical workers in banks are expected to be numerous throughout the 1960's. A number of jobs will be provided in new branch banks which will be opened especially in suburban areas of large cities, as well as in long-established banks that expand their services. In addition, a greater number of job openings will arise as a result of high turnover rates—common in occupations where women comprise a major proportion of the work force.

As the banking industry continues to expand in the long run, clerical employment is expected to increase somewhat. (See general employment outlook section on p. 520.) However, an important factor that must be considered is the effect the introduction of additional automatic office equipment will have on clerical employment. Over the years, banks have been using an ever increasing number of bookkeeping, calculating, and other machines, and still have continued to expand their employment. Nevertheless, it is undoubtedly true that many more clerical workers would have been hired had such machines not been available. New machines—especially electronic computers, already in use in a few banks in 1958—have displaced some clerical workers formerly engaged either in manual handling of checks and related items, or in making computations and recording bank transactions. One large electronic bookkeeping machine, with a few operators, can handle many thousands of entries and withdrawals in customer accounts, automatically calculate service charges, and print a completed monthly statement ready for mailing. Such equipment is expensive and only city banks with a great volume of business can afford to install the large machines. However, less expensive electronic bookkeeping and other types of machines are becoming available for use in smaller banks. These developments will restrict employment growth mainly in routine clerical jobs, such as filing, sorting, and operating calculating and bookkeeping machines. They will also create a smaller number of new jobs, but some of these jobs will require higher skill and will pay better.

(See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information.)

Tellers

(D.O.T. 1–06.02 through .04)

Nature of Work

Each bank employs one or more tellers whose chief duties are to receive deposits, handle withdrawals, and make change for customers. More than 60,000 tellers are employed in banks of all types. (See chart 35.)

Paying and receiving tellers—by far the largest group and the one with whom most people have contact—begin their work on a typical day by obtaining their individual cash boxes from the vault. If the teller believes more money will be needed in the course of a day's work, he orders more coin and currency. During banking hours for the public, the teller is mainly occupied with cashing customers' checks and handling deposits and withdrawals. Before a check is cashed, he must verify the signature, and the identity of the person to whom he makes payment, and be certain that account balances are adequate for payment. Approval is usually obtained from the head teller or an officer when checks for large amounts are presented. In handling deposits, the teller must usually compare deposit slips with the amounts tendered and make entries in a passbook or on deposit receipts.

After public banking hours, the paying and receiving teller "proves" his cash. He usually counts the cash on hand, lists the currency-received tickets on a settlement sheet, makes any necessary adjustments, and takes the settlement sheet to the proof department. These tellers may perform other incidental tasks such as counting deposit slip items for analysis purposes, filing new account cards, and removing closed-account cards from files. They may supervise one or more clerks assigned to assist them.

Many other kinds of tellers are employed, particularly in large banks. These tellers are usually identified by the department to which they are assigned or the kind of financial papers which they handle. For example, trust tellers receive and issue receipts for the payment of promissory notes and discount tellers perform clerical work connected with the issuance and collection of customers' notes.

Training, Other Qualifications, and Advancement

Teller positions are usually filled by promoting experienced clerical workers, in accordance with the "promotion-from-within" policy followed by most banks. Seniority, coupled with ability proven in related clerical jobs, affects chances for advancement to teller positions.

Increasing numbers of tellers in banks are women.

Since much of the teller's work involves contact with the public, personal characteristics such as neatness of appearance, courtesy, tact, and a pleasant manner are important. Many customers rate a bank's services principally by the impression they receive from their dealings with tellers. Since tellers are responsible for handling money, they must be trustworthy. When they make changes in customers' accounts, accuracy as well as speed is important in their work.

Tellers who perform ably for a number of years may be promoted to head teller or to some other senior supervisory position. They may also qualify eventually for a bank-officer position, particularly if they have had college training.

Employment Outlook

Additional tellers will be needed in the 1960's to service the growing population and to take care of the expected expansion in the volume of bank transactions. The trend toward establishment of more branch banks will provide additional opportunities for tellers. Although use of mechanical equipment to speed up tellers' duties will probably be extended, the use of new machines is not expected to affect employment of tellers as much as that of many other types of clerical workers.

Opportunities for women to advance to teller positions have improved greatly since the beginning of World War II. About half of all bank tellers are women, and opportunities for women clerks to advance to teller positions will continue to be numerous.

(See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information.)

Bank Officers

(D.O.T. 0–85.10; 0–97.01 through .05, .14; 0–98.01 through .06, .08, .11, .12, .13)

Nature of Work

About a sixth (over 100,000 in 1958) of all bank employees are officers. The number of officers in a bank and their titles and responsibilties depend upon the size of the bank and the particular services offered. In a large bank, departments such as trust, credit, investments, and real estate may each be supervised by an assistant officer. These officers in turn may be responsible to a senior officer—vice president, treasurer, comptroller or cashier—in charge of several departments. The bank president exercises general supervision over all operations. Some small banks or branches are run almost entirely by the cashier or a vice president acting as manager. It should be noted that unlike cashiers in other businesses, who make change and count cash, the cashier in a bank is the executive officer generally responsible for bank funds.

A bank officer makes decisons within the framework of policy as set by the board of directors. A broad knowledge of business activities is required, which must be related to the operations of the particular department involved. For example, the loan officer must exercise his best judgment in approving loans, bearing in mind general business conditions and the local community situation. He must carefully evaluate the reports of credit analysts (usually executive trainees) on the individual or business firm applying for a loan and balance the favorable and unfavorable elements in reaching a decision. Similarly, the trust officer must have a thorough understanding of a particular trust agreement, in order to manage properly a fund or estate. Only the wise investment of trust funds will enable fulfillment of a trust agreement, such as provision for sending a young person to college or paying pensions to employees of a business enterprise. Besides supervising financial services, these and other bank officers are frequently called upon to give advice to individuals and businessmen and to participate in community projects.

Training, Other Qualifications, and Advancement

Employers in banks have, in recent years, shown a marked preference for college graduates in selecting persons to be trained for officer positions. Outstanding individuals with experience in banking are sometimes considered for executive trainee jobs, however, even if they have only a high school education.

Bank officer discussing details of a loan with young couple.

Specialized college education is seldom required for executive trainee positions. However, a business administration curriculum with a major in banking is excellent preparation; other helpful majors are accounting, finance, or statistics. A liberal arts curriculum with some courses in the fields mentioned and in economics, political science, and commercial law, is usually considered good preparation. Courses in English composition are also desirable.

In-service training aimed at developing future bank officers is given in most banks. Programs are generally designed to give a trainee the "feel" of banking and to help bank officers determine the position for which the employee is best suited in the long run. Most large city banks have well-organized training programs, ranging from 6 months to 2 years in length. Trainees may work as credit or investment analysts, or be rotated among various clerical jobs in several bank departments. Assignments to teller positions may be made in smaller banks. In other programs, trainees study, observe, and write reports on the operations of the departments to which they are assigned. Though many small banks cannot operate formal officer-trainee programs, they usually have some plan designed to help promising employees gain enough understanding of various banking operations to qualify for later advancement.

Advancement to officer positions may come slowly in small town banks, which are often operated largely as family enterprises and in which little turnover occurs. In large city banks with special training programs, initial promotions may come more quickly. However, many years of service are usually required to obtain the thorough knowledge of bank operations, bank customers, and the community, needed to qualify for senior officer positions.

Although experience, ability, and leadership qualities receive great emphasis when promotions are made, advancement may also be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school. The courses are usually offered locally and most banks pay tuition fees after employees successfully complete their courses. More advanced training is offered in graduate schools of some universities—one of the better known is the Graduate School of Banking conducted each summer at Rutgers University by the American Bankers Association. Similar school sessions are sponsored by State bankers associations.

Employment Outlook

Banks will offer a good many employment opportunities during the 1960's for college graduates who meet the standards for executive trainees. A number of new positions will probably arise from the expected overall expansion of banking discussed in the introductory section of this chapter. Additional junior officers may also be needed as the increasing use of electronic computers makes possible more extensive analysis and planning of bank operations. However, most openings for officers will continue to result from turnover. The American Bankers Association estimates that resignations, retirements, and deaths normally result in about 5,000 openings for new officers each year. However, competition for promotion will remain keen, particularly in the largest banks.

Opportunities for women have improved in recent years and the outlook is favorable for continuation of this trend. Women bank officers—a rarity in the 1920's—comprised about 10 percent of all officers in 1958. Most of the women officers were employed as assistant cashiers.

(See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information.)

DEPARTMENT STORE OCCUPATIONS

Customers who shop in department stores can buy most of the goods they need—ranging from armchairs to zippers—in one building. In order to purchase, assemble, display, sell, and deliver their merchandise, the country's more than 2,500 department stores employed about 800,000 people in 1958. Approximately half of these workers were salesmen and saleswomen; the others included managers, buyers, personnel workers, advertising specialists, stenographers, bookkeepers, porters, elevator operators, wrappers, and deliverymen.

Department stores are an important source of employment in all major cities and many suburban areas. Their business is so great that the dollar volume of their sales is recognized as an important indicator of the Nation's economic health. Of the 70 different types of retail businesses, the only ones which employ more workers than department stores are food stores and eating and drinking places.

Nature and Location of Department Store Business

Department stores are distinguished from other retail stores by their large size, and by the enormous variety of their merchandise sold in many different departments, all located under the same roof. "Bargain basements" are another unique feature of many department stores.

These stores also offer customers many services, including various forms of credit, delivery of purchases, gift wrapping, and telephone and mail-order service. Many have facilities such as beauty parlors, watch and jewelry repair shops, restaurants, and, in some cases, even small post offices. Frequently, specialists are employed to advise customers on such matters as planning of parties, weddings, or home decorating.

The largest department stores are giant establishments with several thousand employees each. However, the business also includes stores with as few as 25 employees. A growing proportion of department stores are members of chain organizations. Some belong to regional or national chains which may include 100 or more stores. In addition, a few mail-order companies operate large numbers of department stores. A growing number of department stores, including independently operated stores as well as members of chain organizations, operate branch store outlets.

Department stores and their employees are concentrated in downtown areas of cities and, to an increasing extent, in the suburbs of large cities. Most major department stores—those with 500 or more employees—are in big cities. Nearly every city with more than 10,000 population has at least one department store.

Department Store Occupations

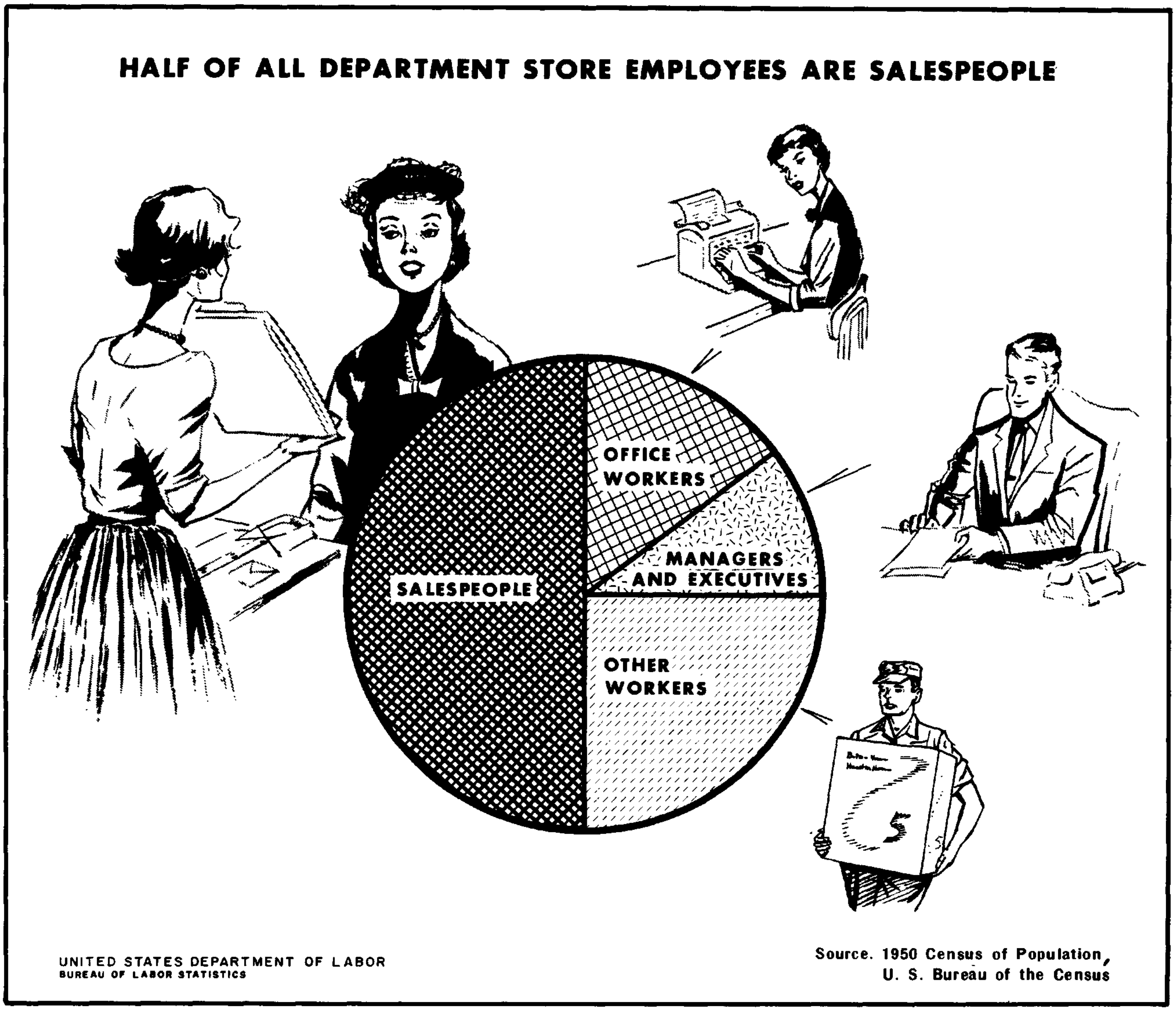
Department store work includes five major functions—merchandising, store operations, financial control, sales promotion, and personnel management.

Merchandising—the buying and selling of goods—is the hub of all department store work, and the great majority of employees in merchandising work are directly engaged in selling. (See chart 36.) The proportion of salespersons tends to be somewhat lower in large than in small stores, since the larger stores have a greater number of specialized sales supporting personnel to handle customer services and other activities needed to complete a sale. Salespeople include not only regular, full-time employees but also many thousands who work part time regularly every week or for only a few weeks during the year. It has been estimated that about 20 percent of all department store sales personnel are employed on a part-time basis.

Personnel concerned with merchandising work also include an important group of executives—the buyers and their supervisors, the merchandise managers. These merchandising executives, who try to anticipate consumer preferences when buying goods, comprise a majority of all department store executives.

The largest group of workers behind the scenes in department stores is engaged in store operations. In this group are many thousands of employees who move and store goods in the store

CHART 36



and warehouse; receive, check, and mark prices on merchandise to be sold; or wrap and deliver goods after they are purchased. Workers with special skills—fitters, seamstresses, tailors, upholsterers, carpet and linoleum layers, and various types of repairmen—make alterations and repairs on merchandise as part of the service given customers. In addition, since department stores are usually located in large buildings—some covering an entire city block—they need many skilled maintenance workers, such as carpenters, electricians, stationary engineers, and plumbers. They also employ detectives and guards to prevent the theft of merchandise and otherwise protect store property; elevator operators; and porters, maids, and janitors to keep the store clean and perform other incidental duties.

Officeworkers comprise about 15 percent of all department store employees. Some of these clerical workers—file clerks, typists, stenographers, and secretaries—do office work in connection with sales promotion, personnel management, and other nonfiscal aspects of store management. However, the majority are employed in financial control work. Large numbers of bookkeepers, office machine operators, and other officeworkers are needed to handle customers' charge accounts and to keep inventory control, accounting, and budget records. Big downtown stores generally have large-size clerical staffs to handle record-

506397 O—59——35

keeping and other office work for the parent store and, in many cases, for branch stores as well.

A few store employees, mainly people with special creative ability, work on sales promotion. Advertising copywriters, layout men, commercial artists, and other specialists in advertising and publicity, prepare material for publication in newspapers or for radio and television "commercials." They also plan promotional campaigns to bring more customers to their stores. Window trimmers and interior display specialists arrange displays of goods to attract customers.

Supervisors and executives represent approximately 10 percent of all department store employees. Their positions range from that of section or floor manager to such high-level administrative posts as general manager, store manager in charge of the store, merchandise manager, controller, and personnel manager. As mentioned before, the buyers and the people who supervise them are included in this executive group. Although the trend is toward hiring more young college graduates as trainees for executive positions, outstanding salespeople and other experienced employees will continue to have good opportunities for advancement. Department stores also employ specialists and professional workers—personnel workers, accountants, lawyers, nurses, and doctors.

In most major divisions of department store work, women employees are in the majority. Furthermore, women have excellent opportunities for advancement in this business; they comprised approximately 40 percent of all salaried executives in department stores in 1958—a higher proportion than in most major industries. Although most of these women executives are in merchandising work, many are also employed in the controller's division, in sales promotion, and in personnel management.

The work done by buyers, sales personnel, and employees in receiving, delivery, and related jobs —some of the largest and most characteristic groups of department store workers—is described in the separate sections on these occupational groups later in this chapter.

Officeworkers in department stores are not discussed separately since their duties and qualifications are similar to those of clerical workers who handle office records and correspondence in other industries discussed elsewhere in this Handbook. (See the chapters on insurance occupations; banking occupations; and clerical occupations.) Similarly, many of the types of workers employed in store operations (for example, skilled maintenance workers) or those performing specialized services (for example, beauticians and watch and jewelry repairmen) and some of the types of professional personnel utilized by department stores (such as accountants, personnel workers, and commercial artists) are also to be found in other fields of employment. (See index for references to the discussion of many of these occupations in other sections of the Handbook.)

Employment Outlook

Many thousands of job openings, especially for beginners, are expected in department stores each year during the 1960's. Most openings—probably more than 100,000 annually—will result from employee turnover, including resignations, retirements, and deaths. The greatest number of job opportunities will be for salespersons, the largest occupational group, but many clerical workers will also be needed. Sales and clerical jobs have the highest turnover rates, because the majority of workers in these jobs are women, many of whom leave to get married or take care of their families. Turnover is high also among beginners in many sales-supporting jobs, such as those of checker, marker, wrapper, receiving or shipping clerk, and deliveryman—since the experience acquired in these jobs in department stores qualifies young people for work in a variety of other businesses. Thus, many thousands of openings will be available for such positions. In addition, a continuing demand is anticipated for qualified young people to train for executive positions, including those of buyer and sales manager, particularly because of the establishment and growth of branch stores. Some openings will also be available for accountants, advertising and display artists, personnel workers, and other professional and specialized personnel. Moreover, there will be a number of openings for workers who can alter or repair merchandise—seamstresses, tailors, upholsterers, and others.

Besides openings due to turnover, some job opportunities will arise during the next several years, as new branch stores are established in suburban areas. Many branch stores—some as large as the downtown parent store—have already been opened in suburban shopping districts, and more branch stores will be established, as long as population continues shifting to areas around large cities. Industry leaders anticipate continuation of the trend toward the building of large branch stores in giant "regional" shopping centers. In these centers, stores will be bigger, handle a wider assortment of merchandise, and create jobs for larger numbers of workers than most earlier established branch stores. Since relatively more salespeople are employed part time in branch than in parent stores, a comparatively high proportion of the new openings will be in part-time work—an important source of employment for housewives, students, and others.

Employment is likely to remain fairly stable in downtown department stores while new branches become established and grow. Large staffs will still be needed in city stores, which are expected to continue to have a substantial sales volume even though branch stores will probably show greater proportionate increases in sales. Moreover, parent stores will perform a number of functions for branches, such as buying, advertising, accounting, and warehousing of merchandise.

In the department store business as a whole, only moderate growth in future employment is expected. In recent years, department store employment has been fairly stable, with an annual average of about 800,000 workers. Relatively small year-to-year fluctuations in employment have occurred, however, and are likely to continue.

The expected further growth in the population of the United States and rising income levels will play an important part in the anticipated long-run increase in department store employment. Undoubtedly, the total demand for merchandise will, if favorable economic conditions prevail, continue to grow rapidly. A greater population with more money to spend will purchase an ever-increasing amount of clothing, furniture, housefurnishings, radio and television sets, and other goods. However, future levels of business and employment in department stores will depend to a great extent on how effectively they meet the intense competition from other types of retail establishments—for example, stores selling chiefly furniture or household appliances. These and others selling only a few types of goods have, in recent years, increased their share of retail sales at a much faster rate than have department stores.

By 1958, many department stores had made good progress in meeting the intense competition from other kinds of retail stores—including discount houses—each selling only a few types of goods. Other department stores are expected to follow suit. Neglected downtown shopping areas are being improved by store modernization programs; arrangements for customers' parking or transportation are being expanded; and local governments are taking steps to ease congested traffic conditions. In addition, credit facilities are being further emphasized, in order to stimulate purchases. Also, some stores have adopted methods used by their competitors; for example, a new suburban store, described as a combination supermarket, discount house, and bargain basement, is making great use of self-service methods and cut-rate prices. Unique promotional campaigns, warehouse sales, and more night openings are further means by which department stores are trying to increase their business.

The rise in department store sales expected as a result of these measures will probably not lead to an equally rapid rise in employment, for several reasons. Some officeworkers are being displaced by the introduction of improved office equipment—a change commonly referred to as automation. For example, electronic devices are being perfected which will record sales data from price tags in the form of machine punch cards, thus reducing the bookkeeping work involved in inventory control and in handling customers' accounts. Similarly, improved mechanical equipment for handling merchandise may affect employment in certain sales-supporting occupations, such as that of warehouseman and porter. The probable effect of another development—the use of self-service techniques—on employment of salespersons is discussed in the statement on salespeople later in this chapter.

Because of the many offsetting factors which will influence the demand for workers in department stores, the future rate of employment growth in this business is difficult to see. However, some increase in the numbers of department store employees is expected, as already indicated, and there will no doubt continue to be many thousands of openings in these stores each year owing to turnover.

Furthermore, regular employees of department stores have a better chance of stable employment over a long period of time than workers in many other industries. If department store sales should slacken, employment could be reduced by not filling some vacancies or by eliminating part-time jobs. On the other hand, competition for openings in sales and sales-supporting jobs in department stores tends to increase when other jobs are hard to find, since many workers in other occupations can qualify for such jobs.

Earnings and Working Conditions

Inexperienced salespersons generally earned from about $30 to $45 a week in 1958 depending mainly on size and geographic location of the store. In large department stores in cities and suburban areas, beginning salespersons received starting salaries ranging from $40 to $47 a week in mid-1958, according to data based on a small number of union contracts. Salaries are generally increased with satisfactory performance in the same job or when the employee is transferred to a job requiring greater selling ability. Sometimes salespeople, mostly women, fail to progress because they do not remain long enough to qualify for better jobs or because they do not have the selling aptitude needed for better paying sales positions. Although salaries may vary depending on the size of a store and its geographic location, the greatest differences in earnings of salespeople result from differences in the types of goods sold and the selling skills required. For example, salesclerks who sell merchandise such as handkerchiefs, notions, and small housewares, usually earn less than shoe salesmen. The highest earnings—averaging more than $100 a week in some large cities—are usually received by men who sell furniture, major appliances, or floor coverings. Commission earnings—a percentage of sales—are commonly paid in such departments and often a specified minimum amount of earnings is guaranteed in order to cover slack selling periods. Salespersons in most other departments usually receive a fixed salary or a salary plus commissions. Part-time employees are usually paid on an hourly rate basis, but many also receive commissions on sales. Salaries in a number of sales-supporting jobs below the supervisory level compare favorably with and, in some cases, are higher than the earnings of salespeople.

Executive trainees in retailing, many of them college graduates who eventually become buyers, generally received annual salaries ranging from $3,000 to $4,500 in 1958, according to the National Retail Merchants Association. Salaries are usually higher in large than in small stores, and sometimes men are paid more than women. A few stores pay above average entrance salaries to college graduates with advanced degrees. Full-fledged buyers usually receive salaries plus commissions or annual bonuses based upon sales or profits in the department for which they purchase merchandise. Salaries for buyers in department stores of all sizes ranged from $4,500 a year to $25,000 in 1958. About one-third of all buyers earned more than $7,500 a year; more than 10 percent earned over $10,000. Many executives, such as merchandise managers and vice presidents, have higher earnings; more than one-fourth of merchandise managers received salaries of over $20,000 annually.

Most department store employees work a 5-day week of 40 hours or less, although the stores, as a rule, are open 6 days a week. They usually work on Saturdays, when sales volume is heavy. Before Christmas and in a few other peak seasons, longer hours may be scheduled; most stores give nonsupervisory employees additional pay or extra time off during slack seasons to make up for this overtime. Large department stores usually pay a higher than regular rate for hours on duty beyond the normal work schedule. When employees work evenings (usually one evening each week) supper money is often provided. Buyers and other executives may have the same work schedule as other employees, or they may work 6 days a week. They frequently work 5 and 6 days on alternate weeks. However, they may receive longer vacations than nonsupervisory employees.

Department store employees and, in many cases, their direct dependents are usually allowed discounts of 10 to 20 percent or more on merchandise purchased in the store. Christmas and year-end bonuses for employees are also granted by many department stores. Many large stores pay part or all of the cost for employee benefits such as life insurance, retirement plans, hospitalization, and surgical plans.

Generally, work in department stores is performed in clean, well-lighted, and often air-conditioned areas. However, some department store employees, including those in receiving, wrapping and packing, and delivery jobs work in service buildings or warehouses or parts of the store where working conditions may be somewhat less attractive than in selling areas. Most department stores have employee lounges, and the larger ones usually have employee cafeterias where food may be served at cost.

A small proportion of department store workers, principally in large cities, are union members. The union with the largest membership among department store employees is the Retail Clerks International Association. Another organization in the field is the Retail, Wholesale and Department Store Union. Several unions organize workers in certain occupational groups. Among these are the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.); the Building Service Employees International Union; and to a more limited extent, the Amalgamated Clothing Workers of America; and the International Ladies' Garment Workers' Union.

Where To Go for More Information

General information on department store employment may be obtained directly from personnel departments of department stores or from local associations of retail merchants in many of the larger cities. Additional information may be obtained by writing to:

Committee on Careers in Retailing,
National Retail Merchants Association,
100 West 31st St., New York 1, N.Y.

Information on courses related to the retailing field may be obtained from the Superintendent of Schools or the Coordinator of Distributive Education in each community, or from the State Supervisor of Distributive Education in the Department of Education in the State capital.

A list of colleges offering specialized courses in retailing is available from:

American Collegiate Retailing Association.
24 Waverly Pl., New York 3, N.Y.

Buyers

(D.O.T. 0–74.11)

Nature of Work

Buyers have the highly responsible job of selecting and purchasing, from wholesale houses and manufacturers, the huge quantities of goods sold in their stores. A buyer in a large store may specialize in one type of merchandise, but in a smaller store, he may be responsible for purchasing several different kinds of goods. In any event, buyers must order adequate amounts of goods in the proper assortments well in advance of the season; for example—bathing suits in the winter and ski suits in the summer.

Buyers and their assistants comprise a majority of the approximately 80,000 supervisors and executives employed in department stores. A very large store may employ well over 100 buyers, in contrast to the smallest department store where the owner and an assistant may do the buying. About half of all buyers in the business are women.

The exact nature of a buyer's work depends not only on the size of a store but also on the type of organization and other factors. In large national chains, where the buyer must buy for many stores, widely scattered geographically, his function is usually limited to buying. However, in many department stores, buyers (who may also be called department managers) direct all the activities involved in the operation of a sales department. In addition to buying, they usually assist in supervising and training salespeople, help prepare expense budgets, participate in planning sales promotional campaigns and merchandise displays for their department, and perform many other functions. Buyers deal with people at all levels—customers, their own salespeople, department store executives, such as controllers or sales promotion managers, and salesmen from factories and wholesale houses.

In order to select goods that will be sold readily, successful buyers need a great deal of information about merchandise and merchandising. They try to anticipate consumer preferences by keeping informed of the latest fashions and products. They may examine special surveys and evaluate past sales records to determine the kinds of merchandise customers prefer and the prices they are willing to pay. Buyers also rely on information from sales managers in branch stores and on "want slips" prepared by salespeople. In addition, they often spend time on the selling floor of their department to obtain firsthand knowledge about the kinds of goods customers prefer. In many of the smaller stores, they help sell merchandise in their department.

Buyers must have a thorough knowledge of the cost of materials and be able to judge workmanship, in order to bargain skillfully with sellers and obtain the best values for the money spent. They keep informed about the goods available by reading trade magazines and catalogs, and also develop numerous contacts with sellers. In larger stores, buyers spend about 20 to 30 percent of their time visiting merchandise markets throughout the country; sometimes they make trips to foreign markets. To meet the keen sales competition from other stores, the buyer frequently examines reports prepared by "comparison shoppers." In addition, the buyer must take account of general business trends, economic conditions in the particular store localities, and of seasonal, social, and other factors that may affect department store sales.

Although every department store has someone who performs the buying function, buyers are mainly concentrated in large stores and the larger cities. Buyers employed in downtown department stores with branches also buy for these suburban units and visit them to keep informed of their needs. Buyers employed by large national chain organizations, where buying is centralized, usually work in the home office location. Centralized buying is also performed for groups of stores through "resident buying offices" which employ buyers in the Nation's principal market centers—New York, Chicago, San Francisco, Los Angeles, St. Louis, and Dallas.

Training, Other Qualifications, and Advancement

In selecting people to train for the position of buyer, department stores emphasize such personal characteristics as initiative, maturity, the ability to express oneself clearly, a pleasing personal appearance, and ease in dealing with people. Selling experience is also generally considered essential background for buyers' work. Other characteristics emphasized in selecting buyers are the capacity to organize one's work and to work under pressure, a keen interest in and a thorough knowledge of merchandise, and the ability to bargain skillfully with sellers.

Although formal educational training is seldom a specific requirement for buyer jobs, a growing proportion of buyers hired in recent years have been college graduates who may have majored in liberal arts, in business subjects, or in a variety of other fields. A 4-year college course with a major in retailing is also valuable preparation. Such courses usually include retail buying and merchandising, fashion and design, store operations, consumer economics, and mathematics as applied to retailing—pricing, controlling inventories, and analyzing profit and loss statements. Although only a small number of universities and specialized schools offer full 4-year retailing programs, there has been a substantial increase in the number of colleges which offer one or more retailing courses. Study in distributive education programs at the high school level, discussed later in the statement on salespersons, is also helpful. In a few communities, post high school courses in distributive education are offered. These courses prepare adults for junior executive positions, including that of assistant buyer, in department stores.

Since most department stores follow a promotion-from-within policy, outstanding young people who begin in sales work or even in some sales-supporting jobs have opportunities to advance to assistant buyer or buyer positions. In addition, many large department stores hire individuals, mostly college graduates or those with some college training, as trainees for executive positions, including particularly that of buyer. Large department stores may recruit trainees through contacts they maintain with colleges, or they may hire individuals who apply in person. Applicants are interviewed personally and, in some cases, given intelligence or aptitude tests.

Many large stores have formal training programs for executive trainees, which generally last from 6 months to a year. These trainees, including both newly hired college graduates and workers promoted from within, may at first receive formal instruction in merchandising subjects and then be rotated among various jobs where they may handle customer adjustments, do clerical work for buyers, or serve as section and floor managers. Those without previous selling experience usually also work initially as salespeople. After a year or two, trainees may be assigned to work as head of stock, assistant buyers, or in other supervisory capacities.

Individuals who demonstrate ability as assistants are promoted to buyer positions as openings arise. A broad estimate of the average time required to obtain this promotion is from 4 to 5 years; however, individuals may advance in much less time or wait a longer period, depending on the situation in a particular store. The National Retail Merchants Association has indicated that a large proportion of buyer jobs are filled by men and women in the 25- to 35-year age group. In large downtown department stores which have suburban branches, the line of promotion may be from assistant buyer to sales manager in a branch store, and then to buyer in the parent store. Branch sales managers mainly have managerial duties, although they also help buyers by giving them useful information on buying needs. The most successful buyers may also have opportunities for promotion to division merchandise manager in charge of a group of departmental buyers, and later to general merchandise manager at the head of the store's merchandising activities. At the top of the "promotion ladder" are the policy-making executive jobs of general manager, vice president, and president. Most department store presidents have a background of experience as a buyer.

Employment Outlook

Opportunities for advancement to positions as buyers in department stores are expected to remain favorable during the 1960's. The majority of openings will result from retirements and deaths of buyers, and from resignations, especially among young assistant buyers or trainees who do not qualify for advancement or who leave their jobs for other reasons. A moderate number of new jobs will probably become available with the establishment of new branch stores, which are expected to be larger in size and to stock more goods. A few more assistant buyers may also be needed in parent stores, where buyers do the purchasing for branch stores. Some additional jobs will also become available for resident buyers in the specialized organizations that buy goods for groups of stores. Nevertheless, competition will probably remain keen for buying positions, which are better paid and generally considered more challenging than some other department store occupations.

Women will continue to have good opportunities to become buyers, since employers generally recognize that women can compete on an equal footing with men in many buying jobs and are particularly successful in buying women's goods. Buyers in stores which centralize the buying for their branches may spend more time in the future on buying duties and less on managing departments and sales activities.

(See introductory section of this chapter for Earnings and Working Conditions and for additional information on Employment Outlook.)

Salespersons

(D.O.T. 1–70.10; 1–75.; 1–97.)

Nature of Work

Salespersons in department stores spend most of their time behind counters or on sales floors, selling one kind or related kinds of goods. Since they are in contact with the public more than other employees, they help greatly to build the store's reputation by efficient and courteous service.

In large stores, salespersons usually sell a particular type of merchandise—for example, junior-miss dresses, women's and misses' better dresses, or women's inexpensive dresses. In smaller stores, they may handle several related kinds of stock, such as various dress lines and also women's suits and coats, or they may sell widely differing kinds of merchandise throughout the store. The successful salesperson not only sells a large volume of goods but also has a favorable record showing a minimum of sales returns by customers.

After greeting customers and finding out what types of merchandise they want, salespersons help them in their selections and may suggest additional merchandise for purchase. During peak selling periods, they must have the ability to wait on more than one customer at a time. It is obvious that the person who sells articles such as stationery or candy does not have to use as much salesmanship as the person who sells television sets, furniture, or fashion merchandise. However, each salesperson needs a thorough knowledge of the goods in his department, in order to emphasize the chief selling points and serve customers properly. He must usually be able to discuss differences in style, color, size, quality, details of workmanship, and price and may also show customers how to use and take care of merchandise.

Salesman explains the construction of a piece of furniture.

When the customer has decided what he will buy, the salesperson fills out a sales slip specifying the items bought; the price; the amount due for taxes, if any; whether the purchase was made on a cash, C.O.D., or charge basis; and any delivery arrangements. Salespeople also usually make change for customers, using a cash register. At the end of the day, they must balance their cash with their sales sheets and turn in their cash together with sales slips.

Salespersons must keep their stock in order and neatly arranged. When goods run low, they may order an additional supply from reserve stock, and if requested merchandise is not available in the store, they often fill out "want slips" to guide the buyers in ordering goods. From time to time, they assist in taking inventory. In smaller stores, they may also mark goods, put away stock, do display work, and help keep the store clean. The alert salesperson has a general understanding of store operations, so that he can explain the services available and direct customers to the appropriate departments. Sometimes, salespeople are assigned to work as "comparison shoppers." This job involves visiting other stores and obtaining information about styles, quality, and prices of goods in order to help their employer evaluate and adjust merchandising policies.

(For information on salespersons in all types of retail stores, see p. 246.)

Training, Other Qualifications, and Advancement

Employers in department stores prefer high school graduates for sales work. Applicants should have an aptitude for selling and the personal qualities necessary for work where contacts with people are important. A pleasing manner, a neat appearance, and the ability to speak distinctly are assets for salespeople. They must also be physically able to be on their feet all day.

Although specialized educational courses are not required for beginning sales jobs, high school subjects such as commercial arithmetic, speech, and home economics courses which give merchandise information are useful. The most helpful educational preparation is that obtained under the "distributive education" program offered in many local school systems. Under this combined work-and-study program, students are employed part time, at least 15 hours a week, in department or other retail stores. They also take school courses in such subjects as salesmanship, retailing arithmetic, speech, marketing, and the identification and care of all kinds of materials—textiles, woods, or plastics—used in consumer goods. Participation in this program not only helps young people determine if they like department store work but also gives them valuable experience.

Young people who are interested in sales jobs may apply directly to department store personnel offices. Applicants are generally given personal interviews. The applicant who fills out his application form carefully and makes a favorable impression during his interview has the best chance of employment. Some stores give aptitude tests for hiring and job placement purposes. People who have had part-time selling experience are likely to receive preference for full-time jobs. Inexperienced young people are often assigned to sell goods in departments where salesmanship may not be an important factor.

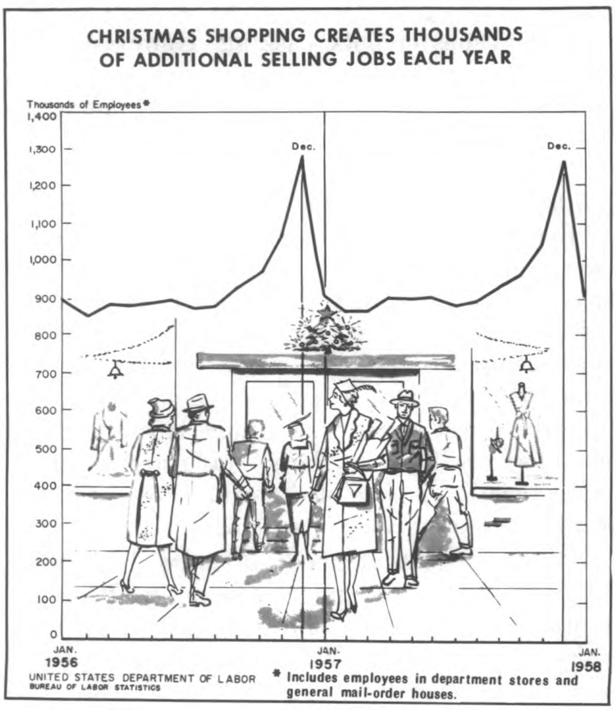
Most department stores have in-service training programs for newly hired salespeople. Large stores usually hold formal training sessions lasting about 3 days to acquaint newcomers with store rules, teach them how to fill out sales slips and use the cash register, and to explain credit facilities and other practical matters. Many stores also stress salesmanship in these preliminary training programs. However, new workers learn how to sell mainly through actual sales experience usually under the guidance of an experienced salesperson, called a sponsor. Many stores help their beginning salespersons in still other ways—through followup training sessions on salesmanship, assistance from section heads or floor managers, and regular meetings with the buyers aimed at providing information on the merchandise. Such information is important, because customers are most likely to buy from salespeople who show that they are thoroughly informed as to style, quality, price, and use of the merchandise they are selling.

A promotion-from-within policy for salespersons is followed by most stores. Salespeople are rated chiefly on their sales and service records and ability to work with people. As openings develop, salespersons may be promoted to section head or head of stock and then to assistant buyer and buyer, or they may be transferred to sales jobs in better paying departments requiring greater selling skills, and later move up the ladder to positions as buyers. However, some salespersons derive great satisfaction and attain high earnings in sales work and therefore prefer to remain in selling positions. Sometimes, salespeople are transferred to and advance in nonselling jobs, such as those in personnel work or store operations. Advancement opportunities for outstanding young people who have little specialized education are better in the department store field than in a number of other industries. It should be borne in mind that experience in sales work in department stores is transferable to jobs, in many other types of retail businesses.

Employment Outlook

Many employment opportunities for salespersons are expected each year in department stores, during the 1960's. A number of workers will be needed to fill new positions, especially in new branch stores, but far greater numbers will be required to replace those leaving the occupation. The fact that most salespersons are women who

CHART 37



* Includes employees in department stores and general mail-order houses.

may leave to marry or to take care of their families, is one major reason for the high replacement rate in sales jobs. In addition, many young people change employment after gaining some sales experience. Many of the employment opportunities that arise will be for older people and housewives, especially as part-time workers in suburban stores. The demand for part-time workers will continue to be unusually high in department stores during peak selling periods, such as before Christmas and during special sales. (See chart 37.)

Growth in employment of sales personnel will depend in part on the extent to which employers use self-selection and self-service techniques. These techniques are designed to help customers examine and purchase goods easily and quickly with little assistance from salesclerks. However, it is not expected that complete self-service will be greatly extended in department stores, since customers appear to prefer personal attention from salespeople. Although department stores have experimented with self-service methods for many years, they have been used only on a small scale by most stores, and least of all for the sale of goods which require an evaluation of quality or demonstration by salespeople. However, if employers should make widespread use of self-service methods, growth in the employment of sales personnel would be limited.

(See introductory section of this chapter for Location of Work, Earnings and Working Conditions, and for additional information on Employment Outlook.)

Receiving, Delivery, and Related Occupations

Nature of Work

Many thousands of department store workers—receiving clerks, checkers, markers, packers, package routers, sorters, and deliverymen—are required to handle merchandise in order to get it to the selling floors and delivered to the customer. Men are usually employed where the work involves handling heavy merchandise, as in unloading operations or bulk packing. However, many women are employed as wrappers or stock girls, where physical strength is not an important factor.

The number of receiving, delivery, and related workers in each store depends mainly on the size of the store and the amount and type of customer service provided. In small stores, an employee may have a variety of duties; for example, a receiving room worker may help unload merchandise, unpack goods, and check for damage or shortages, and also help in marking operations. In the largest stores where huge stocks of merchandise are handled, large staffs are required. Specialization is feasible in such stores, and each worker is assigned a few specific duties.

The movement of goods in large department stores to the sales counters and selling floors requires the cooperative effort of workers in a variety of occupations. Warehousemen and porters unload merchandise from shippers' cars and trucks—often using forklift trucks, conveyor belts, and other mechanical equipment. After stock is unloaded, *receiving clerks* (D.O.T. 1–34.04) compare the shippers' invoices with the number of merchandise packages to see that quantities are correct. Goods are then sent to the *receiving checkers* (D.O.T. 1–34.15) who unpack and check each item for quantity, price, and color, and carefully examine goods for any damage.

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Receiving clerk and his assistants check incoming merchandise.

Markers (D.O.T. 1–12.47) indicate the retail price of each item by using crayons, rubber stamps, or price tickets. They check back to invoices to make sure that the price and departmental identifications are correct. Sometimes, markers use special machines that mark the ticket and attach it in one operation. In large stores, making price tickets and marking merchandise may be separate functions. The last operation in receiving work is usually performed by *stock clerks* (D.O.T. 1–38.01) who store merchandise in stockrooms and fill orders for stock as it is needed on selling floors. *Stock boys and girls* (D.O.T. 9–88.40) bring merchandise to sales counters from reserve stockrooms in the store, when salespeople need additional items. They may also arrange goods on counters and shelves.

Packaging "sold" merchandise for delivery to customers is done mostly by *wrappers* and *packers* (D.O.T. 9–68.30) who work at service counters in the store or warehouse. Wrappers select a bag, box, or carton of the proper size and wrap items securely and neatly. Fragile goods and bulky items are usually handled by packers, who use large, well-made cartons and boxes to protect merchandise against damage. After the merchandise is packaged and properly addressed, it is sent to the delivery department for routing, sorting, and delivery. *Routers* (D.O.T. 1–34.11) place route numbers on packages according to delivery addresses, and *sorters* (D.O.T. 1–34.10) place the packages in bins according to route numbers. Sometimes the router or sorter also does the work of a *sheet writer* or *stubber* (D.O.T. 1–34.08), whose job is to go from bin to bin and record information about outgoing parcels on a record sheet or remove and file stubs attached to packages. Finally, the goods are loaded in delivery order sequence by the delivery truckdriver who may be assisted by a helper.

Training, Other Qualifications, and Advancement

Young people with little formal education may be hired for many beginning jobs, such as receiving clerk, checker, marker, and stock boy and girl. Good work habits and traits such as punctuality, a sense of responsibility, initiative, and leadership are personal assets which help in advancement. Workers in a number of these jobs must be physically able to be on their feet for long periods or to handle heavy and bulky packages.

Like prospective salespersons, young people seeking beginning jobs in store operations may apply to department stores in their local shopping districts. Under the promotion-from-within policy followed by most department stores, workers already employed in the store receive first consideration for supervisory positions. A receiving clerk or marker, for example, may be promoted to "squad head" in charge of a group of receiving room workers. Further promotions to such positions as receiving room supervisor and assistant manager or manager of inside delivery usually depend on an individual's leadership qualities and demonstrated ability.

Although a person's educational background receives little emphasis in beginning receiving and delivery jobs, it can be an important factor in promotion, particularly since capable workers in these occupations are often offered opportunities for advancement in other lines of department store work. For example, outstanding workers who also have the qualities generally considered desirable for salespeople may be transferred to sales work and move up the "job ladder" in the merchandising field. High school graduation, generally preferred for selling work, is particularly helpful if the curriculum included courses in retailing given under the distributive education program.

Employment Outlook

Many thousands of openings for receiving, delivery, and other workers in related occupations are expected each year during the 1960's. Most of the openings are expected to occur from the high replacement rate resulting mainly from younger employees shifting to other jobs in the department store business or changing to other employment. A moderate number of new jobs will probably become available as branch stores are opened in expanding suburban areas. However, proportionately fewer sales-supporting workers than salespersons may be hired in branch stores, since parent stores usually perform some nonselling functions for branches. Though new and improved equipment for handling merchandise will be introduced in shipping and receiving departments, this development is expected to affect only a small proportion of employees, mainly unskilled workers who move merchandise. Jobs of checkers, wrappers, or stock clerks will probably be little affected. The same basic factors that underlie the employment outlook for department store salespeople—rising population and income, and increasing retail sales—are expected to affect employment prospects favorably for workers in jobs connected with receiving, stocking, and delivery operations.

A prolonged economic downturn would likely affect receiving and delivery workers more seriously than sales personnel. Only a small proportion of store operations workers are employed part time, compared with sales workers. Therefore, layoffs of regular store employees in jobs connected with receiving and delivering goods could not be reduced to any extent by cutting down on the number of part-time employees, as might be done in the case of salespeople.

(See introductory section of this chapter for Location of Work, Earnings and Working Conditions, and for additional information on Employment Outlook.)

ELECTRIC LIGHT AND POWER INDUSTRY

America's technological advancement in the past 75 years could not have been possible without electric power. Electricity is used today not only to supplement the working power of the men and women who produce the Nation's goods and services, but also to heat, cool, and light homes and commercial establishments.

Today, over 55 million customers including homes, stores, and factories are serviced by our utility systems which generate, transmit, and distribute electric energy. Many different types of technical and skilled workers are needed to insure the dependable electrical service that utility systems provide. These include such workers as electrical engineers, powerplant operators, electricians, linemen, meter readers, and workers in office occupations. In many communities, the local utility is one of the best sources of interesting and steady jobs.

Nature and Location of the Industry

The electric light and power industry is made up of utility systems which make and distribute electric current for lighting, heating, and operating electrical appliances and machinery used in homes and industry. An electric utility system uses a complex set of equipment—powerplant, substations, and wires—to make electric current and carry it directly to places where it is used.

The instantaneous delivery of electricity to the user as he needs it is the distinctive feature of the operation of electric power companies. Electricity is a form of energy which cannot be efficiently stored in large quantities but must be used almost at the same moment it is produced. Each customer can begin to use current or increase his consumption at any time by merely pushing a button. For this reason, a power company must have sufficient capacity to meet peak consumer requirements at any time during the day or night.

Some utility systems generate, transmit, and distribute only electrical energy; other systems produce both electricity and gas. This chapter is concerned with employment opportunities only in those jobs relating to electric light and power in both types of utility systems. In 1958, private utility systems which generate and distribute only electrical energy employed about 260,000 workers. The private combined gas and electric systems had about 170,000 employees, of whom an estimated 70 percent were working in connection with electric service. In addition to employees found in private utility systems, an estimated 65,000 workers were employed by Federal, State, and municipal utility systems. Manufacturing companies which produce electric power for their own use also employ workers in this field.

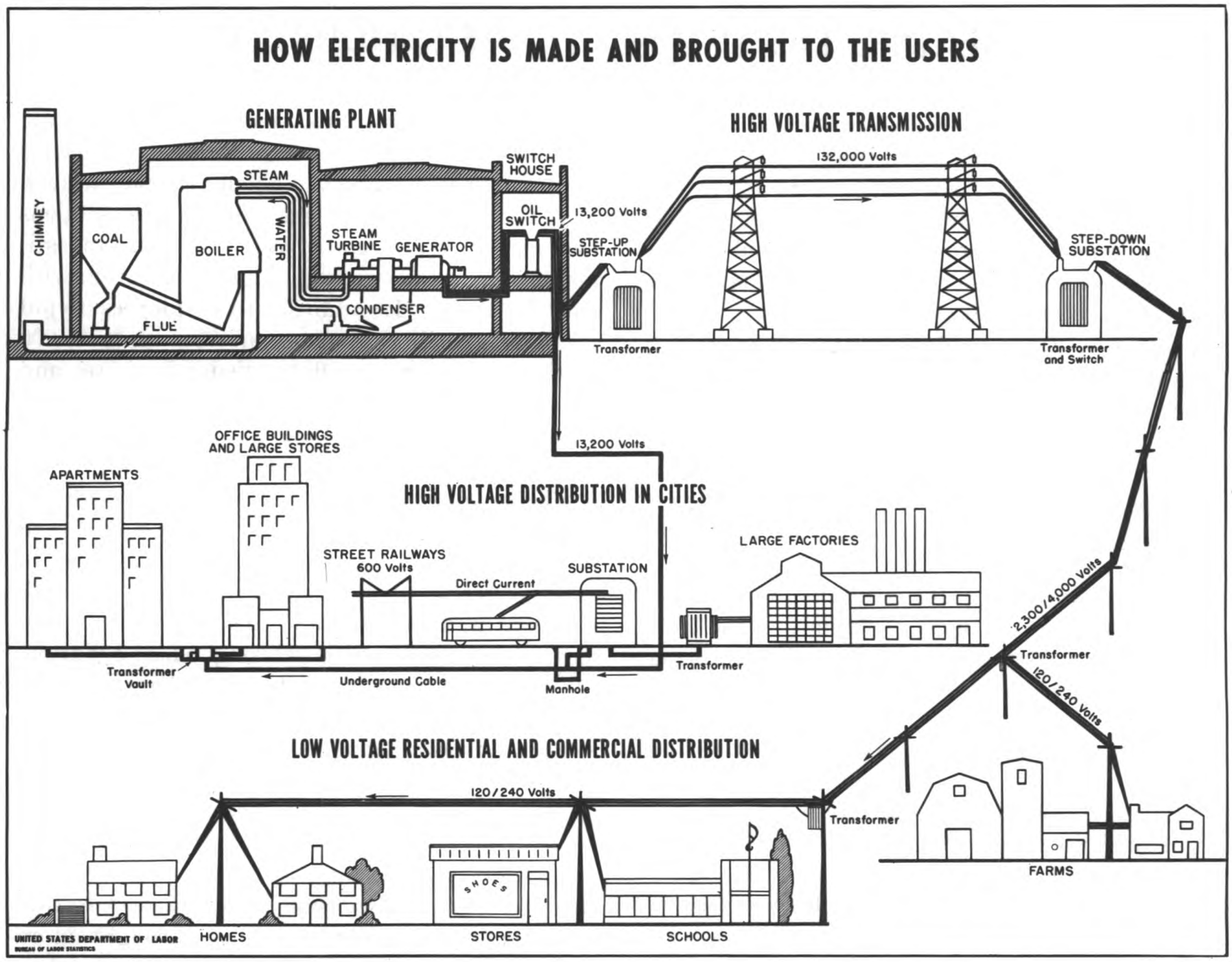
Electric utility service now reaches into almost every locality. About 3,500 electric systems served almost 25,000 communities and rural areas in 1958. Electric utility jobs are found in small towns as well as large, and in rural areas as well as in urban communities throughout the Nation. Most jobs, however, are in the more heavily populated areas, especially where industrialization is extensive. Large cities have a disproportionately large share of electric utility employment, not only because they contain many customers, including large industrial users, but also because the headquarters of most of the large systems are in the cities. The extension of electric service into rural areas in recent years has brought more jobs into the smaller towns. Federal hydroelectric projects have created some new jobs in relatively isolated areas.

Electric Light and Power Processes and Activities

The production and distribution of large quantities of electric power require workers in many different occupations. The number and kinds of jobs in electric utilities are affected by the heavy reliance on automatic equipment. In relation to the volume of sales, fewer electric utility employees are needed than in most other industries.

In 1958, about 14 percent of the workers in this industry were employed in generating plants. About 21 percent were employed in the processes involved in the distribution of power to customers. Because of the great amount of equipment and facilities and the need for keeping them

CHART 38



in good running order, about 17 percent of the workers in utility systems were employed in maintenance or custodial jobs. About 10 percent were in customer servicing jobs. Administrative and clerical workers together made up over 31 percent of the industry's work force and engineering and technical personnel comprised more than 7 percent.

The following brief description of how the electric utility system operates may help provide a clearer picture of the nature and organization of the jobs in this industry. Chart 38 gives a simplified picture of how electric current is generated and how the current travels from the generating station through the transmission and distribution systems to the individual users.

Powerplant Operations. The first process in providing electric power to consumers is the production of electricity in the powerplants of utility companies through the operation of electric generators. Most electric current is generated either by means of waterpower or by steam which uses coal or oil as fuel. However, developments in peacetime nuclear research point to future large-scale commercial production of electricity with the use of atomic energy as a source for power generation. Basic powerplant jobs include boiler operators, turbine operators, and auxiliary equipment operators who watch over and check the equipment which produces the power. Groups of workers known as switchboard operators control the movement of the current through the generating station circuits and onto transmission lines carrying current away from the station to the users. Watch engineers supervise all powerplant employees.

Transmission and Distribution Operations. After electricity leaves the powerplant, it passes onto the transmission lines which link the generating plant to the distribution network serving the individual customers. Transmission lines may carry current from a distant hydroelectric powerplant to the city where it is to be used; or they may carry current from a power station in a city to distribution substations in the various neighborhoods or to substations in outlying areas served by the power company. Transmission lines also serve to tie together the generating stations of a single system or the power facilities of separate systems. In this way, power can be interchanged to meet varying demands.

From the generating plant, electric power is sent through a transformer in a step-up substation in which the voltage (measure of electric force or pressure) is raised in order to send electricity over distances by means of transmission lines. Transmission lines may be carried on tall steel towers across the countryside or they may be buried in lead-sheathed underground cable in cities. The transmission system ends at a step-down substation where transformers reduce the voltage to a point at which the power can be passed on to the distribution system. Wires fan out into a network of other wires which are run to the final users of electric power. A large industrial user may be served by a line running directly from the substation. Individual homes get their current from secondary lines which branch off from the main lines leading away from the substation. The principal workers of the transmission and distribution systems consist of the men who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain power lines—linemen, cable splicers, troublemen, and their helpers.

Customer Service. As the electric power enters the wiring system of a customer's building, it is measured by a meter installed by the local utility company. After the current is measured so that the customer can be billed for his consumption, the physical operations of the utility in bringing power to its customers are completed. Workers in customer service jobs include meter readers who read the consumption figures from the meter and metermen who install, test, and repair meters. Another customer service job is that of the district representative who generally is employed in rural areas. His work includes reading meters, collecting overdue bills, connecting and disconnecting meters, and making minor repairs on them. He also receives complaints about service and reports of line trouble and transmits them to a central office for handling.

The duties, training, and other qualifications; employment outlook; and earnings of workers engaged in powerplant, transmission and distribution, and customer service activities are discussed separately at the end of this chapter.

Maintenance and Custodial Activities. A considerable number of workers are engaged in maintaining and repairing the equipment used by the electric utilities. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important workers in the maintenance jobs are electricians, instrument repairmen, maintenance mechanics, machinists, plumbers, and boilermakers. Electric utilities also employ custodial workers such as janitors, guards, and watchmen. (Detailed discussion of the duties, training, and employment opportunities in the important maintenance occupations appears elsewhere in this Handbook. See index for page numbers.)

Engineering and Technical Activities. Engineers plan generating plant additions and installations of new transmission and distributing equipment, supervise construction and installation, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In most electric utilities, electrical engineers hold a large proportion of the top supervisory and administrative jobs. Many engineers are employed in sales development work to aid industrial and commercial customers in their utilization of electrical equipment and lighting. They stimulate greater consumption of electricity by demonstrating the advantages of electrical equipment and suggesting places where more electricity can be effectively used. About 7 percent of the total employment in this industry is made up of engineering and technical personnel including electrical engineers, draftsmen, and engineering aids. (A detailed discussion of the duties, training, and employment opportunities in engineering and other technical fields appears elsewhere in this Handbook. See index for page numbers.)

Administrative and Clerical Activities. Because of the tremendous amount of recordkeeping necessary for running the business operations of electric utilities, the industry employs a higher proportion of administrative and clerical personnel than many other industries. Nearly a third of the industry's work force is employed in clerical and administrative jobs. Many of the workers in these jobs are women. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, and accounting and auditing clerks are employed by electric utilities. These workers keep records of the services rendered by the company, make up and send out bills to customers, and prepare a variety of statements and statistical reports. Some of this work is now being performed by data-processing equipment which has recently been introduced in this industry. The use of this equipment is creating new occupations in such fields as programming and computer console operating. Administrative employees include such specialized workers as accountants, personnel officers, purchasing agents, lawyers, and salesmen. (A detailed discussion of the duties, training, and employment opportunities in clerical fields appears elsewhere in this Handbook. See index for page numbers.)

Employment Outlook

Employment in electric utility systems is expected to continue to increase slowly in the 1960's. This rate of increase will probably be slower than the estimated 20 percent growth for the Nation's total working population. Job opportunities for new workers will arise primarily from the need to replace workers who die, retire, or transfer out of the industry.

Since its origin in 1882, when it served 50 customers, the electric light and power industry has grown rapidly. The following capacity and production data illustrate the rapid expansion of the electric utility industry since 1920:

Year	Capacity [1] (kw. in millions)	Production [1] (kw.-hr. in billions)
1920	12.7	39.4
1925	21.5	61.5
1930	32.4	91.1
1935	34.4	95.3
1940	39.9	141.8
1945	50.1	222.5
1950	68.9	329.1
1951	75.8	370.7
1952	82.2	399.2
1953	91.5	442.7
1954	102.6	471.7
1955	114.5	547.0
1956	120.7	600.7
1957	128.8	632.6
1958	142.6	645.1

[1] Kilowatts measure the capacity of electric generators; kilowatt-hours measure the production of electricity—the amount consumed or sold.

The electric light and power industry had its greatest growth after World War II. The capacity of electric generators and the production of electric power almost tripled between 1945 and 1958.

Continued large increases in demand for electric power are expected in the 1960's. Levels of business and industrial activity, consumers' incomes, and population growth are major factors in determining the amount of electric power required. Demand for electric power is affected also by the introduction of new uses for electricity and by the greater use of existing equipment.

Analysis of the various factors affecting the demand for electric power indicates that electric light and power capacity and production may double in the 1960–70 decade. Future demands for electricity can be best understood by considering the needs of each of the principal groups of users of electricity. In 1957, industrial plants purchased more than half of the power sold by utility companies. The use of electricity has become essential in industrial operations for running motors, for lighting, for special processing in the chemical and metallurgical industries, and for many other operations. Considering both the favorable long-term economic outlook for industry in general and the new uses for electricity in industrial processes, a sustained long-run increase in the proportion of electricity consumed by industry may be expected.

Residential customers purchased over a quarter of the electric power from utility companies in 1957. Total demands by households for electricity will increase substantially during the 1960–70 decade because of the increasing population and the growing number of family units; the expected widespread introduction of new types of electrical appliances; and the wider use of already established household appliances, such as television sets, air-conditioning units, and freezers.

About 17 percent of the electric power produced in 1957 was bought by commercial establishments, such as stores, office buildings, theaters, and hotels for light, air-conditioning, heat, and sign display. As new equipment, such as electric cooking equipment in restaurants, is more universally adopted, it is expected that consumption of electricity in commercial establishments will rise. Local, State, and Federal agencies and street and interurban railways and electrified railroads, which consumed the rest of the electric energy produced in 1957, are also expected to increase their use of electricity in the next decade.

Employment in the electric light and power industry has generally grown at a much slower rate than the increase in capacity and production. There are several reasons for this difference in rates of growth. The most important has been the increasing use of instrumentation and the installation of larger and more automatic equipment in generating plants and in transmission and distribution departments. With manpower needed mainly to check gages and control instruments, the introduction of new and more efficient equipment has made possible great increases in output per worker employed.

Similar developments will continue to affect the number of new workers needed for the prospective utility expansion. Most of the new generating plants will be larger than those now in use, and larger powerplants require far fewer employees per unit of output. The plants will have modern layouts including centralized control operations which tend to reduce employment requirements. New equipment for transmission and distribution of power is generally more trouble-free and flexible than the older types, requiring less maintenance work and line work. More efficient billing and recordkeeping systems and the introduction of electronic data-processing equipment will enable utilities to handle more customers per clerical employee. In many cases, employers are giving their clerical workers additional training so that they may be able to operate this new equipment.

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As a result of these factors, only a small increase in employment can be expected in the electric light and power industry despite the anticipated doubling of capacity and production during the 1960–70 decade. However, there will be some differences in the rates of growth among the various occupational groups employed by the electric utilities. For example, maintenance craftsmen will increase at a faster rate than most other occupational groups because of the need to maintain the growing amount of machinery and equipment. On the other hand, the building of unattended substations in residential areas may reduce the need for substation operators. (The employment outlook for some of the important electric utility occupations is discussed at the end of this chapter.)

Although the continued expansion of electric power output will create some openings for new workers, replacement needs will be the major source of job opportunities. The electric light and power industry employed almost 450,000 workers in 1958. Thousands of job openings for new workers will arise each year to replace those workers who retire, die, or transfer to other fields of work.

Earnings and Working Conditions

Earnings in the electric utility industry are generally higher than in other public utility industries and in many manufacturing industries. In April 1959, nonsupervisory employees of electric light and power utilities averaged $2.57 an hour or $104.86 a week.

Most nonsupervisory electric utility workers in the production, transmission, and distribution departments are union members. The bargaining agent for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Some utility workers are represented by independent unaffiliated unions.

Because electric utility companies give continuous service to their customers, supplying electricity is a 24-hour, 7-day a week job. Therefore, some utility employees must work schedules which include evenings, nights, and weekends. Generally, electric utility union contracts call for premium pay for overtime work in excess of 8 hours a day or 40 hours a week and for holiday work. Most contracts also provide that the rate of pay for evening and nightwork be higher than the basic day rate. In 1957, workers on the second shift received from 5 to 12 cents an hour more than the basic day rate, and those on the third shift received 15 cents an hour over the basic day rate. Overtime work is sometimes required in this industry, especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report to work during nonscheduled hours, the worker is generally guaranteed a minimum of 3 or 4 hours' pay at his basic hourly rate, and travel time to and from the job is counted as worktime.

In addition to these provisions which affect the pay envelope directly, other benefits for utility workers are provided by electric companies. Periods of annual vacation are granted to workers according to length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 15 years, 3 weeks for 15 to 25 years, and 4 weeks for more than 25 years. The number of paid holidays a year ranges from 5 to 12 days, depending on locality. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments.

The frequency of accidents per man-hour worked is much lower in the electric light and power industry than in most manufacturing industries. Workers in some occupations are more subject to accidents than others. Accidents occur most frequently among the line and cable splicing crews. Among the more frequent causes of injuries are electrical shock, falls from poles and towers, blows from falling or flying objects, and motor vehicle accidents. Around the generating plant and substation, failure to observe safety regulations while working near high voltage lines and equipment may jeopardize the life of the worker. Such accidents, however, are not common. Because of the dangers of electrocution and other hazards, the electric companies and unions have made intensive efforts to enforce safe working practices. Utility companies have set up safety rules for employees to follow. Strict adherence to safety standards is required. As a result, the accident rate has been declining in recent years. In 1957, there were 7.1 disabling injuries per million man-hours worked among the employees of electric utility systems compared with an average of 11.4 in all manufacturing industries, according to a Bureau of Labor Statistics survey.

Where To Go for More Information

Additional information about jobs in the electric light and power industry can be obtained from the local electric utility company or from the local offices of unions which have electric utility workers among their membership. If no union is listed in the telephone directory, write to the following national headquarters and ask them to refer your letter to their nearest branch:

International Brotherhood of Electrical Workers,
1200 15th St. NW., Washington 5, D.C.

Utility Workers Union of America,
1413 K St. NW., Washington 5, D.C.

Powerplant Occupations

Nature of Work

The powerplant operators are the core of the powerplant staff. They are responsible for watching, checking, and controlling the operation of the various kinds of equipment. They must see that the equipment is functioning efficiently and detect instantly any trouble which may arise. There are four classes of powerplant operators—boiler operators, turbine operators, auxiliary equipment operators, and switchboard operators. Supervision of the operation of the powerplant is handled by a chief engineer and by the watch engineers under him. At the other end of the scale are the laborers and helpers who assist the operators.

Boiler operators (D.O.T. 5–72.930) regulate the fuel, air, and water supply used in the boilers, and maintains proper steam pressure to turn the turbines. He does this by means of control valves, meters, and other instruments mounted on panel boards. One man may operate one or more boilers. In many powerplants, coal is fed to the boilers by mechanical coal stokers. In more modern plants, pulverized coal, oil, or gas is piped into the boiler. Coal and ash handlers, cleaners, and helpers remove the ash if coal is the fuel. Boiler operators, of course, are employed only in steam generating plants, none being needed in hydroplants.

Turbine operators (D.O.T. 5–51.120) control and operate the turbines and generators. In small plants they may also operate auxiliary equipment or a switchboard. Modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures; therefore, close attention must be given the pressure gages, thermometers, and other instruments which show the operations of the turbogenerator unit. Turbine operators record the readings of these instruments and also check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers which change the steam back into water. They are also responsible for starting and shutting down the turbines and generators as directed by the switchboard operator in the control room. Other workers, such as helpers, cleaners, and oilers, assist turbine operators. Sometimes, auxiliary equipment operators are under his supervision.

Auxiliary equipment operators (D.O.T. 5–51.115) regulate and tend such varied equipment as pumps, fans and blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. They check and record instrument readings which show how the equipment is functioning. Since auxiliary equipment may go out of order occasionally, the operators must be able to detect trouble quickly, make accurate judgments, and sometimes make repairs. The various types of auxiliary equipment are essential to the

Boiler operator regulates the fuel, air, and water used in boilers by means of valves, meters, and other instruments.

powerplant process since they are directly connected with the operation of the boilers and the turbines. As powerplants become larger, the auxiliary equipment increases in complexity and size and more of it is required to operate the plant.

In some of the smaller plants, there are no separate auxiliary equipment operators. The turbine operators handle this work along with their other duties. In large plants, however, auxiliary equipment operators often outnumber turbine operators. Auxiliary equipment is used only in steam generating plants.

Switchboard operators (D.O.T. 5–51.130) control the flow of electric current in the generating station from generators to outgoing power lines. They usually work in a control room which is separated from the generating room and which has switchboards and instrument panels. Switches control the movement of current through the generating station circuits and onto transmission lines carrying the current away from the station to the users.

Instruments show such information as the power requirements on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage of the current. The operator uses the switches to distribute the power demands among the generators in the station, to combine the generator current, and to regulate the passage of the current onto various power-lines in accordance with demands of the users served by each line. When changing power requirements on the station make it necessary, he orders generators started or stopped and at the proper time connects them to the power circuits in the station or disconnects them. For most of these operations, he receives telephone orders from a load dispatcher in the system headquarters who controls the flow of current throughout the system.

The switchboard operator and his assistants also make frequent tests on instruments to see that current is moving through and out of the powerplant properly and that correct voltage and frequency are being maintained. Among his other duties, the switchboard operator keeps a log of all switching operations and of load conditions on generators, lines, and transformer banks. He obtains this information by making regular meter readings.

In plants with high generating capacity, the equipment is generally more varied and complex than in smaller plants. Disturbances in the system may have far-reaching effects, causing interruptions in service over a large area. As a result, switchboard operators switch their lines and test their equipment more frequently than operators in smaller plants, and thus require a greater degree of skill.

In some of the new powerplants, duties of the switchboard operator may be combined with those of boiler operator and turbine operator. In such cases, he may be called a *control room operator.* Generally, these powerplants are constructed with controls from all departments centralized in the control room. From the central control room, the control room operator, with several assistants, watches all powerplant controls and directs the boiler repairman or the turbine repairman to make repairs when the instruments show that the equipment is not running properly.

Watch engineers (D.O.T. 5-95.320) are the principal supervisory workers in a powerplant. They supervise the employees responsible for the operation and maintenance of boilers, turbines, generators, auxiliary equipment, switchboards, transformers, and other machinery and equipment. Watch engineers may be supervised by a chief engineer or a plant superintendent who is generally in charge of the entire plant. In small plants, the watch engineer may be the top supervisory employee.

Training, Other Qualifications, and Advancement

New workers in powerplants generally are hired as laborers or cleaners. They gradually advance to more responsible jobs as they learn about operating the equipment and as openings occur. Formal apprenticeships in powerplant jobs are rare.

Typically, after starting as a laborer or helper, it takes from 1 to 3 years to become a fully qualified auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be a boiler operator may spend from 2 to 6 months as a laborer before being promoted to the job of oiler. Depending on openings and the worker's aptitude, the oiler may either advance to boiler helper and eventually to boiler operator, or transfer to the maintenance department and work his way up to boiler repairman. Most large cities require that boiler operators be licensed.

In many plants, turbine operators are selected from among the auxiliary equipment operators. The line of advancement in other companies is from laborer to turbine helper. The helper then may either advance to turbine operator or he may transfer to turbine repairman, depending on openings. Where a system has a number of generating plants of different size, operators get experience first in the smaller stations and then are promoted to the larger stations to fill vacancies. Most large cities require that turbine operators be licensed.

Switchboard operators work first as helpers, then as junior operators, and finally as senior operators. They also may advance from small stations to larger ones where operating conditions are usually much more complex. Some utility companies take men from among the substation operators and transfer them to switchboard operating jobs. The duties of both classes of operators have much in common. In the larger plants, switchboard operators can advance to the job of chief switchboard operator.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator is usually required to qualify for a watch engineer's job.

Employment Outlook

Little increase in powerplant employment is expected during the 1960's despite the anticipated large expansion of generating facilities. Replacement needs, however, will provide several hundred opportunities for new workers to enter this field of employment each year.

New plants and replacements for wornout and obsolete equipment have many automatic operating features not contained in many of the older units. This greatly reduces the number of workers required per unit of capacity and output. For example, one operator can generally handle a large modern turbogenerator unit which turns out 150,000 kilowatts as well as he can handle one that produces half that amount. Moreover, occupations in generating plants are gradually being consolidated. With growing centralization of automatic controls, operators are able to tend more equipment. For example, in some plants, one man and his helper can watch the controls for three boilers or three turbines. The addition of another boiler or turbine does not necessarily mean the addition of another operator. Furthermore, the trend has been to rotate boiler operators and turbine operators so they can get experience on both types of operations. These factors have resulted in little increase in employment in powerplant occupations despite greatly increased generating capacity.

Job openings will result primarily from the need to replace those workers who die, retire, or leave the industry to take other jobs. Death and retirement alone will create about 4,000 job openings in the 10-year period between 1960–70.

The introduction of atomic energy as a fuel, replacing coal, oil, and waterpower, will not greatly affect the number or skill requirements of powerplant employees. Generally, about the same number and types of operators will be required to run an atomic-powered plant as are required to operate a steam generating plant.

Earnings and Working Conditions

The earnings of powerplant workers vary according to the type of job and the geographic location of employment. The following tabulation shows the average hourly earnings in the United States and the range of earnings, based on a regional breakdown, for major powerplant occupations in late 1957:

	United States average hourly earnings	*Regional range of average hourly earnings*
Auxiliary equipment operator	$2. 22	$2. 02–$2. 44
Boiler operator	2. 48	2. 13– 2. 55
Control room operator	2. 80	2. 45– 2. 95
Switchboard operator	2. 59	2. 33– 2. 86
Turbine operator	2. 53	2. 35– 2. 70
Watch engineer	3. 08	2. 48– 3. 45

A powerplant is typically well lighted and ventilated and its interior presents a very orderly appearance. Even steam plants are generally quite clean since coal is handled by mechanical equipment separated from principal work areas. The turbine room is airy and clean, but there is usually considerable noise from the whirring turbines. Switchboard operators in the control room often sit at the panel boards, whereas boiler and turbine operators are almost constantly on their feet. Not much strenuous activity is required of powerplant operators and rarely any lifting. Since generating stations usually operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends.

Transmission and Distribution Occupations

Nature of Work

More than a fifth of the workers employed by electric light and power companies are in transmission and distribution jobs. These workers are primarily employed in getting electric power to the users. The principal workers of the transmission and distribution systems are the men who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain power lines—linemen, cable splicers, troublemen, groundmen, and helpers. Linemen make up the largest single occupation in the industry.

Load dispatchers (D.O.T. 5–51.520) (sometimes called system operators) are the key operating workers of the transmission and distribution departments. They control the flow of electricity. The load dispatcher's room is the nerve center of the entire utility system. From this location, the dispatcher controls the plant equipment used to generate electricity and directs its flow throughout the system. He gives telephone orders to the generating station switchboard operators and to the substation operators. He directs how power is to be routed and determines when additional boilers and generators are to be started or shut down in line with the total power needs of the system.

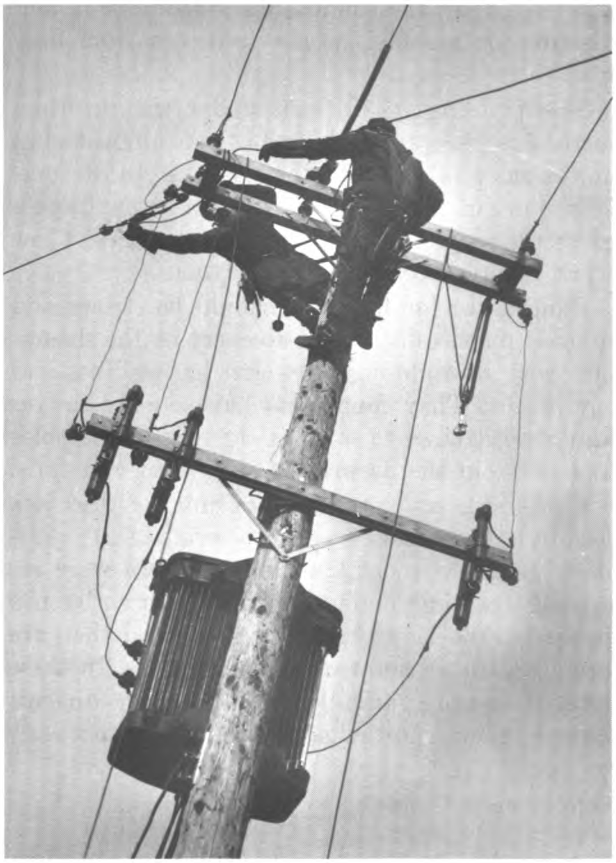
The load dispatcher must anticipate demands for electric power before they occur so the system will be prepared to meet them. Power demands on utility systems are not constant; they change from hour to hour. A sudden afternoon rainstorm can cause a million lights to be switched on in a matter of minutes, but boilers often must be heated for as long as 2 hours before they are ready to produce sufficient steam for generating. The load dispatcher must, therefore, keep in touch with weather reports from hour to hour. He must also be able to direct the handling of any emergency situation, such as a transformer or transmission line failure, and to route current around the affected area. Load dispatchers are also in charge of the interconnections with other systems, and they direct the transfer of current between systems as the need arises.

The load dispatcher's source of information centers in the pilot board which dominates the dispatcher's room. The board is a complete map of the utility system which enables the dispatcher to determine at a glance the conditions that exist at any point. Meters show the output of individual power stations, the total amount of power being produced, and the amount of current flowing through the principal transmission lines. Red and green lights may show the positions of switches which control generating equipment and transmission and distribution circuits as well as high voltage connections with substations and large industrial customers. The board may also have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 5–51.210) are generally in charge of a substation and are responsible for its efficient operation. Under orders issued by the load dispatcher, he directs the flow of current out of the station by means of a switchboard. The switchboard in the substation is similar in purpose to the switchtower in a railroad yard. Incoming energy from the powerplant is switched to the outgoing lines on which it is needed. Depending upon the type of substation, electrical voltage may be either raised or lowered. The flow of electricity from the incoming lines to the outgoing lines is controlled by the circuit breakers. The substation operator connects or breaks the flow of current by pushing or pulling the switches which control the circuit breakers. Ammeters, voltmeters, and other types of instruments located on the switchboard register the amount of electric power flowing through each line. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls the converters which perform the change simultaneously.

In addition to his switching duties, the substation operator must check the operation of all equipment and see that it is maintained in good working order. He supervises the activities of the other substation employees on his shift, and assigns tasks and directs their work. However, in small substations he may be the only employee.

Linemen (D.O.T. 5–53.420) construct and maintain powerlines which carry electricity from the generating plant to the consumer. On new construction, special line crews customarily erect the steel towers for transmission lines. The digging of holes and the raising of wooden poles is largely done by the *groundmen* (D.O.T. 9–54.10) under the supervision of the linemen. The linemen bolt or screw crossarms to the poles or towers, and nail or clamp insulators in place on the crossarms. With the assistance of the groundmen, they raise the wires and cables and install them on the poles or towers by attaching them to the insulators. In addition, linemen attach a wide variety of equipment to the poles and towers, such as lightning arrestors, transformers, and switches.



Much of the linemen's work consists of repairs or routine maintenance.

Although the installation of new lines and equipment is important, much of the linemen's work consists of repairs or routine maintenance. When wires, cables, or poles break, it means an emergency call for a line crew. Linemen splice or replace broken wires and cables and replace broken insulators or other damaged equipment.

In some power companies, linemen specialize in particular types of work. Those in one crew may work only on new construction and others may do only repair work. In some cases, linemen specialize on high voltage lines using special "hot line" tools.

Troublemen (D.O.T. 5–53.422) are journeymen linemen with several years of experience who are assigned to special crews which handle emergency calls for service. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communication with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution systems. They first locate and report the source of trouble and then attempt to restore service by making the necessary repairs. Depending on the nature and extent of the trouble, a troubleman may restore service in the case of minor failure, or he may simply disconnect and remove damaged equipment. He must be familiar with all the circuits and switching points so that he can safely disconnect live circuits in case of line breakdowns.

Cable splicers (D.O.T. 5–53.950) install and repair underground lines, performing about the same service as the linemen do on the overhead lines. When cables are installed, the cable splicers supervise the laying of the conduit and the pulling of the cable through it. The splicers then join the cables at connecting points in the transmission and distribution systems. At each connection or break in the cable they wrap insulation around the wiring and seal the cable with lead joints in much the same way a plumber closes a pipe joint. Most of the actual physical work in the placing of new cables is done by the helpers and laborers who are members of the cable laying crew.

Cable splicers spend most of their time in repairing and maintaining the cables and changing the layout of the cable systems. Splicers must know the arrangement of the wiring systems, where the lines are connected, and where they lead to and come from. Each line is numbered throughout its length at every connecting point and switchbox and at the control board of the generating plant or substation. Splicers must make sure that wires do not get mixed and that the continuity of each line is maintained from the substation to the customer's premises.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from among the experienced switchboard operators and operators of the larger substations. Usually, at least from 7 to 10 years of experience as a senior switchboard or substation operator is required for promotion to load dispatcher. To fill an opening for this job, an applicant must demonstrate his knowledge of the entire utility system.

Substation operators generally begin as assistant or junior operators. It usually takes 3 or 4 years of on-the-job training to become an operator in a large substation. Often workers begin in small substations and are promoted to larger stations as they become more experienced.

It usually takes about 4 years of on-the-job training to qualify as a journeyman lineman. In some companies, this training is given through a formal apprenticeship but in many systems, the training of linemen has not been formalized. Under a formal apprenticeship, there is a written agreement, usually worked out with the union, which covers the content of the training and the length of time the apprentice works in each stage of his training. A principal feature of apprenticeship compared with informal training is that the apprentice is definitely assured of becoming a journeyman lineman if he completes his training satisfactorily. Also, his promotion from one training step to another occurs at specific intervals. The apprenticeship agreement generally contains a provision that at least 144 hours of classroom instruction a year be given to the apprentice. The courses include blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical currents. In 1958, about 800 linemen were receiving their training under a formal apprenticeship program.

The apprentice usually begins his training as a groundman; he assists the lineman by helping to set poles in place and by passing tools and equipment up to him. After a training period of approximately 6 months, the apprentice begins to do simple linework on "dead lines" (lines of low voltage). While on this work, he is under the immediate direction of a journeyman lineman or the line foreman. After about a year, he is assigned more difficult work, but is still under close supervision. During the last part of his apprenticeship, the trainee does about the same kind of work as the journeyman, but with more supervision. When he begins to work independently as a journeyman lineman, he is first assigned less difficult routine tasks. After he acquires several years of experience and demonstrates a thorough knowledge of the company's transmission and distribution systems, he may advance from lineman to troubleman.

The training of linemen under the informal method is generally similar to the apprenticeship and usually takes about the same length of time. The worker begins as a groundman and progresses through increasingly difficult stages of line work before becoming a journeyman.

Candidates for linework should be strong and in good physical condition to carry on the strenuous work of climbing poles and lifting lines and equipment. They must also have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

Cable splicers get their training on the job, usually taking about 4 years to become fully qualified. In 1958, about 900 cable splicers were receiving training under a formal apprenticeship program. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are gradually assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

A continued slow increase in the employment of transmission and distribution workers is expected during the 1960's. Replacement needs will provide most of the job openings in this field of employment.

There will be differences in the rate of growth among the various transmission and distribution occupations. Because of the need to construct and maintain the growing amount of transmission and distribution lines which are anticipated in the 1960–70 decade, the number of linemen and troublemen are expected to increase more rapidly than the other occupations in this industry. However, even for linemen, the increase will be moderate. Little increase in the number of cable-splicers is expected because most large cities are already equipped with underground line installations and little expansion of underground construction is anticipated because of its high cost compared with overhead wire installations. The number of substation operators will show little, if any, growth. The introduction of improved and more automatic equipment and the growing use of unattended substations in residential areas may actually reduce the need for substation operators.

The need to replace transmission and distribution workers who die, retire, or transfer to other fields of work should result in a few thousand job opportunities each year.

Earnings and Working Conditions

The earnings of transmission and distribution workers vary according to the type of job and the geographic location of employment. The following tabulation shows the average hourly earnings in the United States and the range of earnings, based on a regional breakdown, for major transmission and distribution occupations in late 1957:

	United States average hourly earnings	*Regional range of average hourly earnings*
Groundman	$1. 82	$1. 60–$2. 13
Lineman	2. 65	2. 42– 2. 85
Load dispatcher	3. 13	2. 84– 3. 50
Substation operator	2. 57	2. 09– 2. 71
Troubleman	2. 70	2. 48– 2. 90

No recent earnings data are available for cable splicers; however, according to past information, their earnings are about the same as those for linemen.

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen and troublemen work outdoors in all kinds of weather and they must do a considerable amount of climbing. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of unions, have greatly reduced the hazards of these jobs.

Customer Servicing Occupations

Nature of Work

Workers in customer servicing jobs include those who read, install, test, and repair meters so that the utility companies can accurately charge each customer for his consumption of current. Also in this group are company agents in rural areas and appliance servicemen working in company-operated shops which repair electrical equipment owned by the customers.

Metermen (D.O.T. 5–83.456) (or meter repairmen) are the most skilled workers in this group. They may install meters and frequently test them, but their main job is to repair meters on company-owned property, such as those in powerplants and substations, as well as those on customers' premises. Some metermen can handle all types of meters, including the more complicated ones used in industrial plants and in other places where large quantities of electric power are used. Others specialize in repairing the simpler kinds, like those used to record consumption in homes. Often, some of the large systems have meter specialists, such as *meter installers* (D.O.T. 5–83.450, .451) and *meter testers* (D.O.T. 5–83.452). Meter installers install and remove meters. Meter testers specialize in testing not only the small meters on homeowners' property but also the more complicated ones used in relay testing and control operations of the utility systems.

Meter readers (D.O.T. 1–49.94) go into homes, stores, and factories to read the consumption of electric current registered on the meter. They record the amount of current used in a certain period so that each customer can be billed for it. Meter readers watch for, and report, any tampering with the meter, power diversion, and other conditions affecting meters.

District representatives perform customer-servicing jobs. This job is unique in the industry since it includes the duties of several specialized workers. District representatives usually serve as company agents in outlying districts, in localities where the utility company does not have an office and where the small number of customers does not justify the use of more specialized workers. Their work includes reading meters, collecting overdue bills, connecting and disconnecting meters, and making minor repairs on them. They also receive complaints about service and reports of line trouble and transmit them to a central office for handling.

Appliance servicemen (D.O.T. 5-83.041) are employed by some electric utility companies to install, repair, and service electrical appliances either in the company's shop or on the customers' premises. In a large city where many appliance servicemen are employed, they may specialize in servicing only one type of appliance; however, the companies generally require that the servicemen know how to fix many types of appliances.

Training, Other Qualifications, and Advancement

Metermen usually begin their jobs as helpers in the meter testing and meter repair departments. Young men entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training is required to become a fully qualified meterman. Some companies have formal apprenticeship programs for this occupation in which the worker advances along well-defined lines of progression.

Utility companies usually employ inexperienced men to work as meter readers. They generally learn the job by accompanying the experienced meter reader on his rounds until they have learned the job well enough to go out on their rounds alone. This job can be learned in a relatively short time.

Meterman testing a small meter on homeowner's property.

Employment Outlook

Slowly rising employment is expected in this field of work in the 1960's. The many new customers who will be served by electric utilities will lead to an increasing number of meters in use and will result in some increase in the number of meter readers. There will be only a limited growth in the number of metermen because the new meters now being installed are better constructed and require much less maintenance than the earlier models. The need to replace workers who retire, die, or transfer to other fields of work will provide a small number of openings for new workers each year.

Earnings and Working Conditions

The earnings of customer servicing workers vary according to the type of job and the geographic location of employment. The following tabulation shows the average hourly earnings in the United States and the range of earnings, based on a regional breakdown, for customer servicing occupations in late 1957:

	United States average hourly earnings	*Regional range of average hourly earnings*
District representative	$2. 54	$2. 24–$3. 08
Meterman	2. 62	2. 36– 2. 78
Appliance serviceman	2. 42	2. 14– 2. 55

Little information is available on wages of meter readers but an examination of a few union contracts indicates that their hourly rates ranged from $2.01 to $2.25 in 1958.

The job of the meter reader is not physically hard, but he must walk all day and he must usually do a great deal of stair climbing. Metermen and appliance servicemen work indoors under typical repair shop conditions except when repairing or installing meters or appliances on customers' premises.

ELECTRONICS MANUFACTURING OCCUPATIONS

The electronics industry is expected to provide many job opportunities for persons with widely differing levels of skills and education during the 1960's. This industry, which manufactures a wide range of electronic products used in national defense, research, and in factories, offices, schools, hospitals and homes, employed more than 450,000 workers in late 1958. The industry more than doubled its employment between 1947 and 1958 and further large increases in employment are expected in the 1960's.

Nature and Location of the Industry

This industry was generally known before World War II as the radio industry. Its principal products were radios, broadcasting equipment, other receiving and transmitting equipment, parts, and electronic tubes. However, with the rapid development of other products in the general field of electronics, the broader term "electronics manufacturing" has come into general use.

Electronic products utilize the properties of electrons (very light, negatively charged particles) especially in vacuum or gas filled tubes and in semiconductor devices. Within the electronic product, electrons flow through various circuits consisting of wires or printed circuits; tubes and semiconductors; and many other components. The primary job of controlling this flow of electrons is done in the electron tubes and semiconductor devices. Many electronic products, such as broadcasting equipment, radios, radar, and navigational equipment, transmit or receive radio waves through the air.

The industry's products may be divided into four major groups: (1) consumer products, (2) military and industrial equipment, (3) electronic tubes and semiconductor devices, and (4) other electronic components. Consumer products include television sets, radios, high fidelity sets, phonographs, recorders, and hearing aids. The list of military and industrial equipment is much more extensive. It includes the electronic guidance systems needed for guided missiles and satellites. Another important group of military products are electronic detection devices (radar) and automatic communications and computing systems which protect the country from surprise attack.

The industrial and scientific products made by the industry include electronic testing instruments and control devices, equipment used in broadcasting and telecasting, and electronic microscopes and telescopes.

The manufacture of electronic tubes is another major activity of the industry. Plants producing tubes usually specialize in manufacturing one of the following types: Receiving tubes, such as miniature and subminiature tubes; television picture tubes; and special purpose tubes such as klystrons, magnetrons, and cathode ray tubes. Other electronic components such as transistors and capacitors make up the fourth major group of products.

Electronics manufacturing plants are located in nearly every State. The States with the largest number of electronic workers are Illinois, New Jersey, New York, California, Massachusetts, and Pennsylvania. Metropolitan areas with large concentrations of electronics workers include Boston, Chicago, Los Angeles, New York, Northern New Jersey, Philadelphia, and San Francisco. Many of the newer plants in this industry are in suburban and rural areas.

How Electronic Products Are Made

The following brief description of how electronic products are made is presented to give the reader a better understanding of the types of jobs found in this industry. The wide range of products manufactured and the considerable variations in production techniques make it difficult to generalize about the manufacturing process. Most plants in the industry specialize in manufacturing one type of end product such as television sets or radios or one type of component such as tubes. Even where plants do produce more than one kind of product, each product is generally produced by a separate department or on a separate assembly line.

Research and development are usually kept apart from production, particularly in larger firms, and it is not unusual for these activities to be located at completely separate sites. When research and development and production are under one roof, they are often not closely connected, except in pilot stages of production where engineers are attempting to adapt the design of a product to quantity production.

Plants manufacturing end products are engaged primarily in assembly, but many also have parts fabricating and processing departments. For example, many plants have machine shops, electroplating shops, sheet-metal shops, cleaning and coating sections, and wire fabricating departments.

In the assembly of end products such as television sets, the many components and major subassemblies such as tuners and speakers are brought together and assembled by hand onto chassis or other types of frames. These frames are then fitted into metal or wooden boxes and cabinets. A belt assembly line may be used (in large quantity production) to move the chassis from one work station to another. Where production lots are smaller, workers sit at long benches and push the chassis along. Much of the assembly of military and industrial equipment is done by hand. Assembly of consumer products such as television sets and radios may be partly done by machine. Although hand assembly is still typical of the industry, there is a trend toward mechanization in plants where production is on a large scale.

Assemblers add wires and components, using pliers, soldering irons, and other tools. They are assisted by diagrams, models, and color coding of parts and wires. Parts for assembly may be loose in boxes, fed from hoppers (parts receptacles), or held in special containers or jigs. They are brought to the assembly line as needed by hand truck or other simple means since electronic parts are not bulky. During the carefully timed movement of the chassis down the assembly line, it passes frequent inspection stations where inspectors locate faulty construction and help to maintain quality control. Electronic tubes are the last components added.

In the machine assembly of television sets and radios, printed circuit boards are used. Electrical circuits that are etched on the boards replace most wires in the set. The boards have been punched with holes so that components can be attached. Specially designed insert machines, which are fed by hoppers, position the components into the proper holes in the circuit boards, and mechanical devices underneath the boards clamp or bend over the wires or ears on the bottom of the components, thus locking them into place on the board.


Technician testing component (gyro) for missile guidance system.

Some products are made in small lots or to individual specifications. These products are assembled entirely at one work station where assemblers are highly skilled or, if they are not highly skilled, they work under the drection of a technician.

Major subassemblies such as tuners and record changers are often made by firms specializing in these products, whereas less standard types of subassemblies, such as those that go into military and industrial equipment, are normally made in the plants assembling the final end products. Most major subassemblies are assembled by hand.

Standard components, such as capacitors, resistors, transformers, and coils, are generally manufactured by plants which specialize in particular types of components. A large amount of machinery is used in the manufacture and assembly of these components.

Quality control is essential in electronics production because failure in electronic equipment while it is in operation may not only be expensive but also cause loss of life. Inspection and testing begin when incoming materials are inspected and continue through all stages of manufacturing. After completion of final assembly operations, products are thoroughly tested and, where possible, operated for a period of time. Before delivery to the customer, equipment is usually tested once again, whether it is military equipment, industrial equipment, or a household television set.

Electronics Manufacturing Occupations

A wide range of skills is needed to manufacture the many electronic end products and components and to carry on the intensive programs of research and development. Approximately 35 percent of those employed in the industry are nonproduction workers (engineering, scientific, technical, administrative, and clerical). Almost half of the nonproduction workers are engaged in research and development.

The proportion of nonproduction to production workers differs from plant to plant depending on the product in manufacture. For example, the percentage of engineers, scientists, and technicians is higher in plants manufacturing military and industrial electronic products than in plants manufacturing consumer products, such as television sets. Correspondingly, the proportion of assembly, fabricating, and processing workers is lower in military and industrial electronic products plants than in consumer products plants.

An estimated one-half of the industry's workers are women, most of whom are employed as semiskilled production workers and as officeworkers. However, some opportunities exist for women in nearly all types of positions. The proportion of women varies among the different manufacturing sectors of the industry. For example, women make up more than 60 percent of the employees in tube and component plants, whereas they comprise less than 45 percent of the employment in plants manufacturing military and industrial equipment.

Professional and Technical Occupations. A large proportion of employees in electronics manufacturing are professional and technical workers. Engineers accounted for about 1 out of every 15 jobs in the industry in mid-1958. Electronic technicians and draftsmen made up the largest occupational groups among technicians.

The largest group of engineers are electrical or electronic engineers who are generally employed in research and development, although considerable numbers are also engaged in production, sales, and liaison work. Many electronic engineers work as design engineers; others work as test methods and quality control engineers in production operations. Electronic engineers also work outside the plants as field engineers, sales engineers, and engineering liaison men.

Mechanical engineers and industrial engineers are also employed in substantial numbers. Mechanical engineers work as design engineers in product development and in tool and equipment design. They work also as plant engineers—chiefly concerned with the maintenance, design, and operation of plant equipment. Most industrial engineers work as production engineers or as efficiency, methods, or time-study engineers. Other kinds of engineers employed in electronics manufacturing are chemical engineers and ceramic engineers.

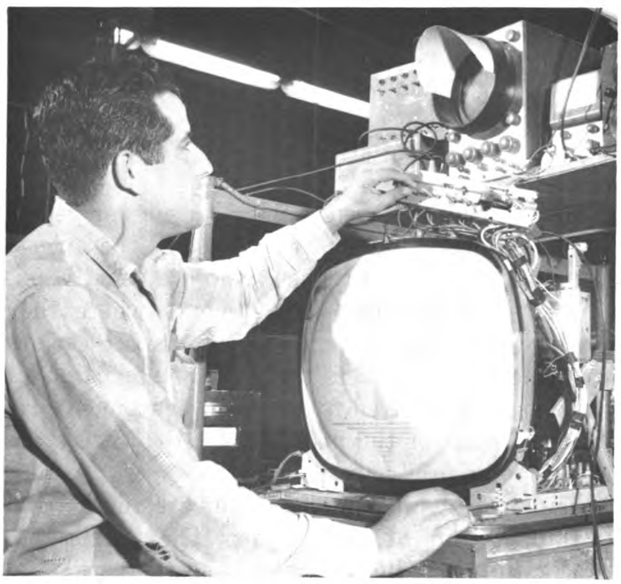
The largest group of scientists employed are physicists, most of whom work on the development of microwave tubes and other semiconductors and on military electronics—particularly for guided missiles. Chemists, another large group, are employed mainly in research work and in materials testing. Mathematicians work with engineers and scientists on complex mathematical problems. Industrial designers work out the form and design of consumer products. (A detailed discussion of the duties, training, and employment outlook for engineers and scientists appears elsewhere in the Handbook. See index for page numbers.)

Many thousands of technicians are employed to assist engineers and scientists. One of the largest groups is that of draftsmen, who are usually employed in engineering departments where they prepare drawings from sketches or specifications furnished by engineers. A higher proportion of draftsmen is required for military equipment production than for the manufacture of other types of electronic products.

Engineering aids and assistants are another important group of technicians. They assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components and systems. Laboratory technicians assist physicists, chemists, and engineers by performing standard and, frequently, routine analyses of a physical, chemical, or electronic nature. Some laboratory technicians set up apparatus and conduct physical or electronic experiments. Mathematical assistants are employed to help in the solving of mathematical problems and in the operation of electronic computers. Assistants carry problems through to completion after the methodology has been outlined by mathematicians.

Electronic technicians comprise the largest group among technicians. They are employed primarily in research and development, in certain highly technical testing and assembly jobs, and in field jobs. In research and development work, electronic technicians assist engineers in the design, construction, and testing of experimental models. They also are employed in production and inspection operations, as described later in this chapter.

Technical writers work mainly in plants making military and industrial products. These writers prepare training and technical manuals describing the operation and maintenance of equipment. They also prepare catalogs, product literature, and project reports and proposals. They work closely with engineers. Specifications writers compile lists of required measurements and of necessary materials. Technical artists or illustrators draw pictures of equipment and components. (For additional information, see statement on technicians which appears elsewhere in this Handbook. See index for page numbers.)



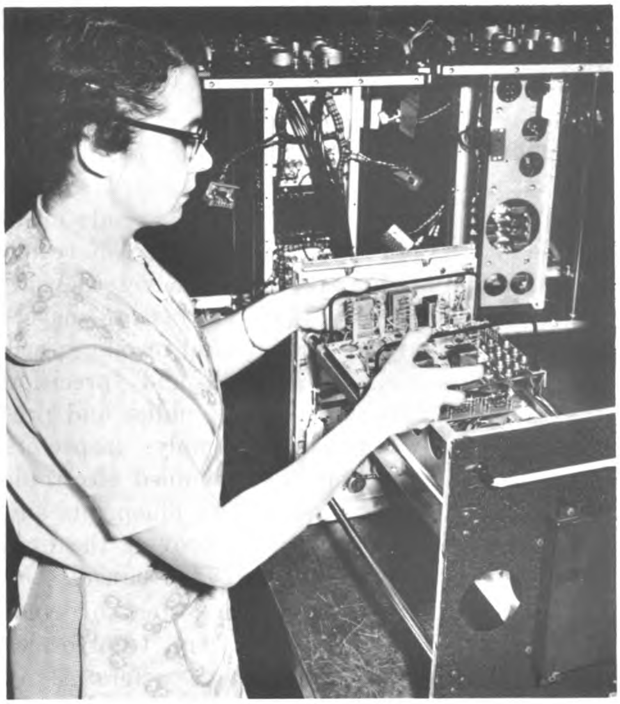
Near the end of an assembly line, a skilled electronic technician checks and adjusts the test pattern on a TV picture tube.

Administrative, Clerical, and Related Occupations. About 12 percent of the industry's workers are in administrative and other office jobs. Among the workers in administrative jobs are accountants, lawyers, and graduates in business administration. Purchasing agents, salesmen, personnel workers, and advertising personnel are also employed by the industry. Among the thousands of office workers are many kinds of clerks; secretaries, stenographers, and typists; and business machine operators. More than half of the office workers are women. (Many of the individual office and administrative jobs are described elsewhere in this Handbook. See index for page numbers.)

Plant Occupations. About 60 percent of the workers in the electronics industry were employed in plant jobs in mid-1958. Plant jobs can be conveniently classified into the following occupational groups: assembly, machining, fabricating, processing, inspection and testing, maintenance, and other plant occupations.

Assembly occupations (D.O.T. 6–98.010 through .350; 7–00.007 through .970). Almost one out of every four electronic workers has an assembly job. Workers in these jobs assemble a great variety of electronic end products, systems, and components. Many different types of assembly jobs are needed in this industry because of the diverse products manufactured. These assembly jobs range in skill from those requiring less than a week of training to those requiring 5 or more years of experience and training.

The most skilled assemblers are frequently called electronic technicians. They are used chiefly to assemble complex apparatus made in small quantities, particularly where a knowledge of theory is valuable. Hence, many are found assembling experimental and developmental electronic equipment. Some electronic technicians join together the various large units and subassemblies in complex systems such as guided missiles. (For additional information, see statement on electronic servicemen and technicians which appears else-



Assembly worker installing a unit in a printed circuit board of a warning radar system.

where in this Handbook. See index for page numbers.)

Assemblers working on military and industrial electronic equipment are usually more skilled than those assembling radios and television sets. The majority of assembly jobs, however, are semiskilled and do not require a knowledge of electronic theory. The semiskilled workers assemble end products (for example, television sets and radar) and components. Most end products are assembled by hand. Only small handtools, soldering irons, and light welding devices are used by the assemblers. Both dip soldering processes and hand soldering may be used. For the assembly of television sets and radios, automatic insert machines are often used. Here the assembler is primarily a machine operator.

A wide variety of hand and machinery operations is used in the assembly of components. Little skill is required to perform most of the jobs, although a few require highly developed skills. The assembly of many components such as coils and resistors involves many individual but simple operations. As a result, special machines have been developed for assembling these components. In such instances, these workers are also called machine operators.

In the manufacture of special purpose tubes, considerably more hand assembly and greater skill are required than for many other assembly operations. In the assembly of the smaller types of tubes, transistors, and diodes, the work is often done under magnifying glasses.

Precision assemblers, employed in the manufacture of military and industrial electronic equipment, assemble a wide variety of precision units where moving parts and mechanisms must operate within close tolerances. Some skilled assembly workers, other than the electronic technicians, are found in repair work, experimental and developmental work, and in making prototypes.

Most assemblers are women—except in the more highly skilled jobs. Men are used in experimental assembly, in the assembly of prototypes, in repair work and trouble shooting, and in assembly jobs requiring heavy work. In the manufacture of military and industrial electronic systems, men connect the major units into a working apparatus (systems assembly).

Machining occupations. About 6 percent of all employees in electronics manufacturing are in metal machining jobs. Almost every large plant employs metal machining workers. Machine tool operators and machinists operate power-driven machine tools to produce metal parts for electronic components and equipment. Toolmakers construct and repair the jigs, fixtures, and instruments used in the plant. Diemakers specialize in making dies needed in punch and power presses. (A detailed discussion of the duties, training, and employment opportunities in individual machining occupations appears elsewhere in this Handbook. See index for page numbers.)

Fabricating occupations. A wide variety of fabricating occupations are found in electronics manufacturing. Although the number of workers in each of these occupations is not large, the total number of fabricating jobs is significant. Among the more important fabricating workers are sheet-metal workers who prepare frames, chassis, and metal cabinets. Many are journeymen and all-round workers employed primarily in development work. Cabinet makers and cabinet finishers make and finish wooden cabinets, used chiefly for television and high fidelity sets. However, most of these workers are engaged in repair and touch-up work, since the cabinets are usually purchased from the furniture industry. Glass blowers and *glass lathe operators* (D.O.T. 7-00.035) are used chiefly in tube experimentation and development and in special tube manufacture, where the tubes are made in small numbers. Other fabricating workers include punch press operators, *blanking machine operators* (D.O.T. 8-98.01), and shear operators.

Some fabricating jobs involve the molding, firing, and glazing of ceramics which are used as insulating materials in many components. Workers may also mold plastic components. In tube manufacturing, there are special fabricating workers, such as the *grid lathe operators* (D.O.T. 6-98.251) who make grids by winding fine wire around two heavy parallel wires. Others employed in fabrication include spot welders, *crystal grinders* and *finishers* (D.O.T. 6-98.080, .084, and .085), and a sizable number of *coil winders* (D.O.T. 6-98.250 and 6-99.013 through .016).

Processing occupations. A sizable proportion of workers are engaged in many kinds of processing jobs. Electroplaters coat many components and parts with metal. Anodizers treat parts in electrolytic and chemical baths to prevent corrosion. *Tinners* (D.O.T. 6-74.120) coat parts with tin. Silk screen operators print patterns on circuit boards. *Etching equipment operators* perform chemical etching of copper on the printed circuit boards.

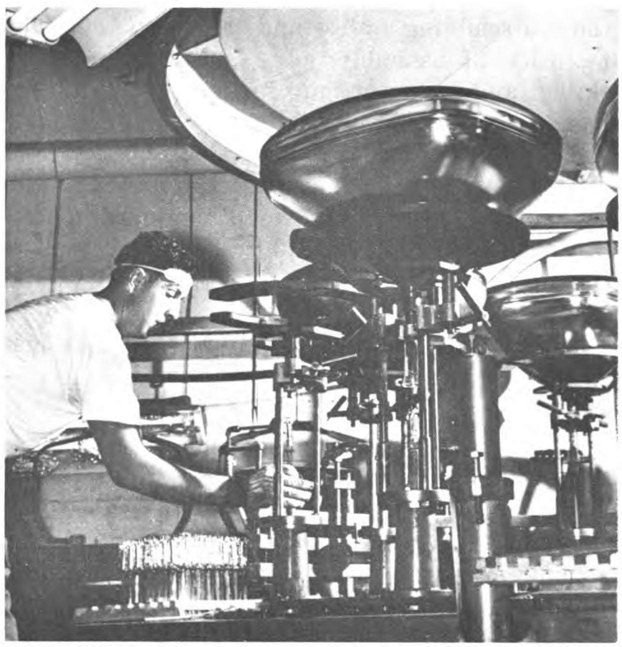
A sizable number of workers are employed in impregnating and coating jobs. Coils and certain other electronic components must be impregnated or coated with waxes, oils, or other materials. Coating jobs are important in tube manufacturing.

Another group of processing workers operate furnaces, ovens, and kilns, which are used chiefly to harden ceramics, to bake on coatings, and to eliminate contamination by gases and foreign materials. *Operators of infrared ovens*, and *hydrogen furnace firers* (D.O.T. 6-98.280) rid tubes of foreign deposits. In tube manufacturing, *exhaust operators* (D.O.T. 7-00.018) and *sealers* (D.O.T. 7-00.025) operate gas flame machines to seal the mount in the bulb, clear the tube of impurities, exhaust the gas, and seal the tube.

Inspection and testing occupations. Inspection, testing, and quality control require greatly varying duties and skills. Inspection jobs generally involve visual inspection or checking with mechanical instruments. Testing jobs are usually performed with electronic testing instruments.

Inspectors of components and materials make up one major group of inspectors. Some have job titles indicating the particular product they inspect, such as cabinet inspectors, plating inspectors, machine parts inspectors, and incoming materials inspectors. Mechanical and precision inspectors check mechanical assemblies and precision parts. Electronic assembly inspectors (D.O.T. 4-98.101) examine assembled electronic units to see that they conform to blueprints and specifications. Final inspectors provide the final visual inspection of the industry's products.

There are various types of testers of components; for example, coil testers, transformer testers, and magnetic component testers. Many workers are simply called component testers. In tube manufacturing, tubes are generally tested on special machines. Among the more common testers in the manufacture of radios and television sets are circuit trouble testers, analyzers, final testers, and type testers.



The operator of this rotary sealing-in machine completes the assembly of television picture tubes.

Some testing jobs require highly skilled, technically trained workers who have had several years of experience in electronic testing. Electronic technicians are frequently employed in such jobs. In research and development, these technicians test circuits and systems. In skilled production testing jobs, missile testers and other systems testers (who may be electronic technicians) test, adjust, and aline complicated systems. Missile component testers and certain other component testers perform similar work on electronic units.

Maintenance occupations. Most maintenance workers care for plant equipment. Electronic technicians repair the many electronic test instruments used in the plant. Machine and equipment repairmen perform mechanical repairs on equipment. Electricians are responsible for the good operating condition of electronic equipment. Hydraulic mechanics specialize in maintaining hydraulic equipment. Maintenance machinists, welders, and sheet-metal workers build and repair equipment, jigs, and fixtures. Since the majority of electronic plants are air-conditioned and many contain special refrigerated and dust-free rooms and equipment, refrigeration and air-conditioning mechanics are needed. Firesetters set up and maintain gas equipment used for sealing glass tubes. Painters, plumbers, pipefitters, carpenters, and roofers maintain the buildings. Most maintenance jobs require skilled workers and many of them are among the higher paying jobs in the plant. (A detailed discussion of the duties, training, and employment opportunities in individual maintenance occupations appears elsewhere in the Handbook. See index for page numbers.)

Other plant occupations. An important occupation in electronic plants is that of the parts changer and repairman. He repairs electronic products which have been assembled but tagged by inspectors and testmen for necessary replacement of parts or for other repairs. Many workers are employed in materials movement and handling. They include operators of plant trucks and tractors for hauling and towing within the plants; forklift operators who stack crates and load and unload trucks and boxcars; and truckdrivers for transportation outside of the plant. Other occupations include powerhouse engineers, boiler operators, and firemen who tend boilers.

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Training and Other Qualifications

Because of the technical nature of its operations and great emphasis on research and development work, the electronics industry employs many engineers, scientists, and technicians. As indicated in the statements on individual occupations, a bachelor's degree in engineering from a recognized college is usually the minimum educational requirement for engineering jobs. Technicians and certain plant production workers also require technical training involving such subjects as electrical and electronic theory, mathematics, drafting, and schematic reading. The industry also has many craftsmen who have served apprenticeships or received special on-the-job trade training. (Detailed information on training and other qualifications for specific professional, technical, and skilled occupations is available elsewhere in this Handbook. See index for page numbers.)

Beginning engineering jobs are usually filled by recent graduates (some with advanced degrees) of colleges of engineering. While college degrees are usually required, a small proportion of engineers have been upgraded to the engineering classifications from such occupations as engineering assistant and electronic technician.

Almost all mathematicians, physicists, and other scientists employed in this industry have college degrees and a relatively high proportion have advanced degrees. Job prospects are better for those scientists with at least a master's degree in their field than for those with only a bachelor's degree.

Technicians generally need some specialized training for their jobs. Most highly skilled electronic technicians have completed a trade course in either a private technical school or in an Armed Forces school, although some workers in testing and experimental assembly jobs have been upgraded to electronic technicians after they have developed the required skills and acquired the necessary basic knowledge in electronic theory. Some electronic technicians learned their trade through apprenticeship programs. Two years of training in a technical school and 5 or 6 years of experience are often the requirements for the more highly technical jobs. Some technicians doing final testing must hold licenses from the Federal Communications Commission as first- or second-class commercial radiotelephone operators.

Chemical and physics laboratory technicians, engineering and scientific aids and assistants, and mathematical assistants frequently have had 1 or more years of college training in a scientific or engineering field but have not completed the course and obtained a degree; in other cases, these workers have been upgraded from jobs as helpers or lower grade assistants. In hiring helpers or lower grade assistants, electronic firms give preference to high school graduates who have completed high school courses in mathematics, physics, and chemistry.

Draftsmen usually entered their trade by taking a course in drafting at a trade or technical school; a few have served a 3- or 4-year apprenticeship. A few entered the occupation through an informal arrangement which combines on-the-job training and part-time schooling.

Electronic firms prefer to hire technical writers who have writing ability as well as some educational or experience background in science or engineering. Some technical writing jobs are held by engineers. Degrees in English and journalism provide valuable qualifications, but an understanding of the technical field is also necessary. Those hired as illustrators have usually attended special schools and received experience outside or within the industry.

Many of the apprenticeable occupations such as tool and die makers, machinists, and electricians are found in electronics manufacturing. These craftsmen usually learned their trade by serving a 4- or 5-year apprenticeship, although some entered these trades through upgrading from helpers' jobs. Some have taken courses at vocational trade schools which have helped them learn the trade.

Formal training is not necessary for workers entering many of the plant jobs, although a high school or technical school education may be required for certain jobs. On-the-job training, usually of a short duration, is normally provided for workers starting jobs for which they have had no previous experience. In most electronic plants, inexperienced workers are assigned to semiskilled assembly and inspection jobs, or to less skilled jobs in parts fabrication and materials movement Jobs requiring greater skill or experience are filled by upgrading promising workers from lower grade jobs. Seniority is frequently a factor in selecting individuals for promotion to higher paying jobs.

Generally, requirements for filling administrative and other office jobs in this industry are comparable to those in other industries. Certain beginning administrative jobs in electronics manufacturing are normally open only to college graduates with degrees in business administration and accounting. More and more employers require college training for jobs in advertising, personnel, accounting, and other administrative jobs. Usually a high school education is required for office and clerical jobs, many of which are held by women. Employers usually prefer applicants who have had special training in stenography, typing, bookkeeping, and the operation of office machines.

Employment Outlook

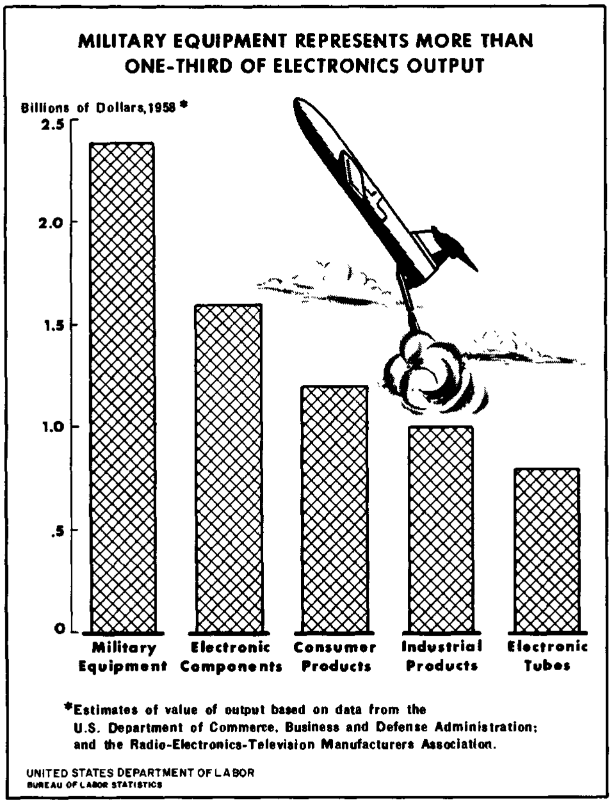
There will be thousands of opportunities for new workers to get jobs in electronics manufacturing during the 1960–70 decade. Employment in the industry which rose from about 200,000 to 450,000 over the past 11 years is expected to continue to grow rapidly during the 1960's. Thousands of additional job openings will arise annually because of the need to replace workers who retire, die, or transfer to other industries.

Expenditures for defense needs will be a principal factor in the expansion of this industry. Increasing demand for industrial and consumer electronic products will also contribute to the industry's rapid rate of growth. (Chart 39 illustrates the relative importance of the major groups of products manufactured by the industry in 1958.)

Expenditures for military electronic equipment have been rising steadily over the past few years, both in volume and as a percentage of total military expenditures, and these trends are expected to continue in the next decade. Particularly large expenditures are expected for electronic equipment in guided missiles and in detection and communications systems. In the years ahead, the Nation's space program will probably expand substantially and require larger quantities of electronic equipment.

Growth in electronics production for industrial use is also expected to be marked. In general, the greatest relative growth for industrial electronics can be expected among the newer types of equip-

CHART 39



ment such as electronic controls. However, even the industry's older and more developed industrial lines, such as broadcasting equipment, radio communications, test instruments, and navigational equipment, will continue to expand. There will also be great expansion in the production of electronic equipment for medicine and science.

In the consumer field in 1958, television sets and radios comprised the bulk of electronic product sales. Other important consumer products included high fidelity sets, phonographs, and tape recorders. These products will continue to be the principal electronic consumer items in the 1960–70 decade. While other consumer products, such as electronic stoves are already on the market or being developed, it is unlikely that they will be produced in large quantities within the next few years. Nevertheless, electronic equipment in such fields as lighting, air conditioning, refrigeration, heating, and communications may eventually be standard household equipment in the years ahead.

The increase in employment will probably not be as great as the expansion in output because technological improvements in production methods are expected to increase output per worker. Mechanization of operations formerly done by hand (such as many of those in assembly, processing, or materials movement), which is being increasingly introduced, will probably reduce labor requirements. However, many of the industry's products do not appear to be adaptable to highly automatic manufacturing processes, since they are made in small quantities and require frequent design changes. Moreover, the expansion of research and development activity should result in new products and increasing employment in this industry.

There will be differences in the rates of growth among the occupations in electronics manufacturing. The growing volume of research and the increasing application of scientific and engineering principles to production operations will result in an accelerated growth in the number of engineers, scientists, and technicians needed in the next decade. There will be a greater demand for electronic engineers and electronic technicians than for most of the other technical occupations. Many opportunities will also develop for other types of engineers, physicists, chemists, and laboratory technicians.

The need to maintain and repair growing amounts of machinery and equipment will also result in an increasing need for skilled maintenance workers. Because of increasing mechanization of manufacturing operations, semiskilled workers in nearly all plant operations will increase at much slower rates than those for scientists and maintenance workers.

Earnings and Working Conditions

Production workers in electronics manufacturing plants (except those employed in manufacturing receiving tubes) earned an average of $84.99 a week or $2.13 and hour in April 1959. This compares with average weekly earnings of $89.87 or average hourly earnings of $2.23 for production workers in all manufacturing industries in the same month. The slightly lower average earnings of workers in the electronics industry reflects the sizable proportion of semiskilled assembly and inspection workers. Skilled workers in electronics manufacturing usually receive the prevailing wage for their particular trade in the area in which they work.

The following listing of straight-time hourly earnings for selected occupations in late 1958 is based on data collected from a number of large companies.

Assemblers, semiskilled	$1. 40–$1. 95
Assemblers, precision	1. 85– 2. 35
Machinists	2. 00– 2. 65
Electronic technicians	2. 30– 2. 85
Inspection occupations	1. 50– 2. 75
Testing occupations	1. 65– 2. 90

Little information is available on the earnings of professional and technical personnel in this industry. (Data on the earnings of individual professional and skilled occupations in industry as a whole are given elsewhere in this Handbook. See index for page numbers.)

Most workers in the industry receive 2 or 3 weeks' vacation with pay, depending on their length of service. The majority of firms give their employees 6, 7, or 8 paid holidays a year. Almost all electronics workers are covered by sickness, insurance and death benefit plans.

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are usually clean and air-conditioned because sterile conditions and air temperature control are necessary for the manufacture of much electronic equipment. Plants are also well lighted and relatively free from noise. The work in most electronic occupations is not strenuous. However, many assembly line operations require continual repetition of many small tasks which creates monotony. Many employers strive to relieve this monotony by frequent rest periods. Cafeterias, recreational facilities, and social programs are also provided for employees, and some plants provide music during working hours.

Injuries in electronics manufacturing are less frequent and less severe than those in manufacturing as a whole. Shock from high voltages is the most serious hazard, but few workers are required to work with high voltages. Burns from soldering irons, cuts, bruises, punctured fingers, and similar minor injuries are the more common injuries.

Many of the workers in this industry are employed in unionized plants and are covered by collective bargaining agreements. The principal unions in the industry are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists; and the United Electrical, Radio and Machine Workers of America (Ind.).

HOTEL OCCUPATIONS

Everywhere people travel in the United States, whether for business or pleasure, they find hotels and motels ready to cater to their comfort. The gigantic business of providing a "home-away-from-home" is a source of employment for a great number of workers who serve travelers in cities and towns, along highways, and in remote resort areas in every section of the country.

Rooms for guests and restaurant facilities are the chief services provided by hotels and motels. Large city hotels also have banquet rooms, exhibit halls, and spacious ballrooms—to accommodate conventions, business meetings, and social gatherings. Many large hotels employ professional entertainers and have recreational and entertainment facilities such as swimming pools and roof gardens. In addition, most hotels provide guests with information about interesting places to visit, sell tickets to theaters or sporting events, and, will even make arrangements for babysitting services. For the convenience of guests, there are newsstands, gift shops, barber and beauty shops, and valet and laundry service. Today, the fast growing motel business, which primarily attracts automobile travelers, is also increasing the types of services offered.

Approximately half a million people (excluding proprietors) were employed in 1958 in hotels, motels, and related businesses. Roughly 80 percent of these workers were employed in the Nation's 25,000 hotels; about 10 percent were in the substantially larger number of motels. The remainder were in related businesses, such as summer camps, dude ranches, and rooming and boarding houses. About half of all the employees in hotels and related businesses were women.

Many hotel workers are in occupations which require a minimum of training. However, the demand is increasing for specially trained people in many departments. Hotels are complex organizations and need experienced personnel who know the business "from the ground up"—to direct and coordinate operations which may involve thousands of guests annually and millions of dollars worth of property and equipment.

This chapter deals with employment opportunities in both hotels and motels. Following the introductory sections, which give an overall view of the hotel (and motel) industry and its workers, are separate statements on several occupations unique to hotel operations.

Nature and Location of the Hotel Business

Hotels are of three main types—commercial (transient), residential, and resort. Commercial and residential hotels operate all year round, whereas resort hotels are generally seasonal in nature and may be open only a few months during the year. The vast majority of hotels are commercial ones, which cater mainly to travelers seeking a room for a brief stay, often for only one night. In contrast, residential hotels chiefly accommodate people for long periods, ranging from a few months to many years. Resort hotels primarily provide lodgings and recreational facilities for people on vacations. Motels (also referred to as motor hotels, and tourist cottages) provide lodgings chiefly to automobile travelers.

Hotels range from modest two- or three-story establishments to towering buildings covering large areas. The smallest commercial and residential establishments have fewer than 25 rooms and only a few employees. The largest have 1,000 or more rooms and may employ as many workers as there are rooms; less than 2 percent have 500 or more rooms. Resort hotels range from the small "family operated" type to those employing several hundred workers (many of them college students) for a few weeks or months during the year. Motels are typically small. Most of them have between 15 and 20 rooms and employ, on the average, only 1 paid worker per establishment; a small proportion have 40 or more rooms. Many motels are of the "mom-and-pop" type—run by the owners, frequently without any paid help.

The majority of hotels have restaurants, ranging from simple coffee shops to vast dining and banquet rooms with wine cellars and elaborate kitchens. Many large hotels have greater income from sales of food and beverages than from room rentals. Relatively few motels have eating facilities, although a growing number of deluxe ones are being built to include restaurants.

Hotel workers are employed in cities of all sizes and in resort areas. However, by far the greatest numbers are in the large urban centers of the most populous States. Motels are widely scattered, mainly along major highways throughout the country, but with some concentrations on the outskirts of large cities. Texas and California each with nearly 4,000 employees and Florida with approximately 3,000 accounted for nearly 30 percent of all motel workers.

Hotel Occupations

Hotel work involves the largest housekeeping operation in the business world. Many thousands of maids, porters, housemen, linen room attendants, and laundry room workers are employed in the housekeeping departments of the Nation's hotels. These employees work in "back of the house"—making beds, cleaning rooms and halls, moving furniture, hanging drapes, providing guests with fresh linens and towels, operating laundry equipment, and marking and inspecting laundered items. Women are usually employed for the lighter housekeeping tasks, whereas men do jobs requiring more strenuous physical effort, such as washing walls and arranging furniture. Large hotels usually employ executive housekeepers to supervise these workers, and some hotels may also have a special manager in charge of laundry operations.

Food preparation and service is another large hotel operation. Hotels employ many kitchen workers ranging from unskilled dishwashers and vegetable peelers to highly skilled cooks and chefs. Many thousands of waiters and waitresses are also required to serve meals in hotel coffee shops and dining rooms. (See chapter on Restaurant Occupations.)

A uniformed staff performs services "up front" in the hotel lobby. This staff includes the bellmen who, directed by bell captains, carry baggage for guests and escort them to their rooms. Elevator operators and doormen are also a part of the uniformed staff; these types of workers, like many others in hotels, are employed in other industries.

The "front office" staff, most of whom are men, work in hotel lobbies as room clerks, key clerks, mail clerks, and information clerks. Their chief duties are to greet guests, assign rooms, and furnish information. Perhaps half of all hotel clerical workers are front-office employees. The remainder of the clerical workers, mainly women, are employed in a variety of office occupations—as bookkeepers, who may operate office machines especially designed for hotel work; as cashiers, who total hotel bills and receive payments when guests check out; as telephone operators; and as secretaries, stenographers, and typists. In 1950, about 10 percent of all hotel employees were clerical workers, according to the U.S. Bureau of the Census.

Managers and their assistants are the executives responsible for supervising hotel operations and making them profitable. They are a small group, compared to the total number of hotel workers, comprising only about 5 percent of all hotel employees in 1950. However, this figure does not include the many hotel and motel proprietors who either manage or assist in managing their own establishments. It also excludes housekeepers, although in the largest hotels, the head housekeepers have a great deal of administrative responsibility. The executive in overall charge of hotel operations is the general manager. Sometimes general managers have executive assistants who may be in charge of the front office and may also assist in various phases of hotel management. Some assistants may be responsible for specific operations; they may be, for example, food service managers who run the dining rooms and other eating facilities, or sales managers responsible for attracting more business to the hotel.

In addition to the occupations mentioned above, hotels have numerous other types of workers who are also found in other industries. Among these are a few thousand accountants and auditors, personnel workers, musicians and entertainers, and recreational workers; these and other professional workers and specialists comprise about 2 percent of all hotel employees. Another and probably larger group is composed of maintenance workers such as carpenters, electricians, stationary engineers, plumbers, and painters. Still other types of workers employed in hotels include detectives, barbers, beauty operators, valets, tailors, seamstresses, and gardeners. (See index for separate statements on many of these and other occupations found both in hotels and other industries.)

Employment Outlook

Many thousands of openings will arise in the hotel business each year during the early 1960's. Most openings will be in the large relatively unskilled occupations—such as maid, porter, houseman, kitchen helper, waiter, and waitress—where turnover rates are high. Turnover in these jobs will remain high as long as favorable economic conditions continue and workers find it easy to shift to other types of employment; another factor responsible for the high turnover rates is that many of the jobs are filled by women who leave after a short period of employment to assume family responsibilities. A number of young people will also be needed as replacements in "front office" jobs, in which vacancies arise partly because some clerks advance to managerial posts. There will continue to be good opportunities for young people who acquire the training and experience necessary to qualify for jobs as cooks, chefs, and food managers. (See chapter on Restaurant Occupations.) Furthermore, employment opportunities for thousands of students and other temporary workers will become available each year in a variety of occupations in resort hotels.

Some new jobs will result from the moderate growth anticipated in the hotel and motel fields through the 1960 decade. However, employment in motels is expected to continue to grow at a faster rate than employment in hotels. Great stimulus will be given to the building of motels, and to a lesser extent of hotels, by the multibillion dollar Federal highway building program which was begun in 1956. A growing number of large, luxury-type motels will be built (some by hotel and restaurant chains), and these will include restaurant facilities and offer many hotel-type services which will require relatively large numbers of workers. Newly created jobs resulting from motel growth will be mostly in service occupations, such as maid and porter, or in food preparation and food service jobs. A few opportunities will also arise for managers.

At the same time motels are expanding their facilities, services, and employment, hotels are taking measures to meet this competition. Business will be stimulated by modernization programs including television and air-conditioning installations, and redecoration and expansion of large public rooms. Other measures which will promote hotel business include the use of credit cards, which allow travelers to charge hotel expenses; reduced rates for families; a deemphasis on formality through the use of hotel drive-in entrances; increased parking facilities (often in the hotel building); and greater effort by hotels to "sell" themselves through intensive publicity, employment of sales managers, or cooperation with local groups in community promotional programs. Many of these factors point to the probable expansion of business—and hence, an increase in employment—in existing hotels. Some increase in employment will also result from the building of new hotels, and from the addition of rooms to older hotels.

In the long run, such factors as rising population and income, and increased travel for business and pleasure are expected to result in a continued slow rise in hotel and motel occupations. Employment in these occupations is not likely to be greatly affected by technological developments, although some workers—particularly in the least skilled service occupations—may be displaced by improved equipment. For example, the expanding use of self-service elevators will result in continuing displacement of elevator operators, and the widespread use of equipment such as automatic dishwashers and vegetable cutters and peelers will reduce the need for kitchen helpers. In addition, improvements in office machines may displace some clerical employees.

Employment in hotels and motels is closely related to economic conditions which affect travel. Jobs, such as those of maid and bellman, in which the largest proportions of hotel workers are employed are the ones which have, in the past, been most affected by economic downturns. Some groups of workers—bell captains, head housekeepers, and managers—have had relatively stable employment.

Earnings and Working Conditions

Hotel workers' earnings depend not only on their occupations but also on the location, size, and type of the hotel. These factors largely determine both the workers' wages and the amount received in tips—a major part of the earnings for many hotel workers, including bellmen, waiters, and waitresses.

Since earnings of bellmen are greatly affected by the tips they receive, it is difficult to obtain meaningful data on their income. In New York City, for example, bellmen covered by union contracts had salaries ranging from about $27 to $34 for a 5-day 40-hour week in late 1958, but with tips, their earnings were probably at least double these amounts. In large luxury hotels and in resort areas, bellmen may earn $100 or more a week (including tips).

Wide differences exist in the salaries of managers, executive housekeepers, and other supervisory workers, mainly because the duties and responsibilities in each of these occupations vary so greatly by size and type of hotel. Average annual salaries of housekeepers in executive posts typically ranged from $3,600 to $8,000 in 1958. In addition, their lodging in the hotel, meals, laundry, and other services are usually furnished. Salaries under $3,000 a year are received by many working housekeepers who supervise few people and spend a large part of their time cleaning rooms and performing related work.

Management trainees who had graduated from colleges which offer specialized hotel management programs had beginning salaries of $3,600 or more in 1958. Increases are usually given trainees periodically for the first year or two, and thereafter may be granted as the employees are shifted to positions involving greater responsibility. Managers with several years of experience may have earnings double or triple beginning salaries. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Data on earnings of various types of service workers and clerks in hotels are available from a survey made in 19 large cities by the Bureau of Labor Statistics. Although the data from this survey are for 1955—and wages have risen since that year—they are nevertheless useful in pointing up the relative differences in pay levels among specific types of jobs. The survey shows that of the occupational groups covered, maids typically receive the lowest pay and room clerks the highest. Women employed as maids averaged from about 75 cents to $1.25 an hour in 1955 in 15 of the 19 cities surveyed. Citywide averages for maids were substantially lower in four southern cities. Average earnings for housemen and lobby cleaners were lowest (about 50 cents an hour) in some southern cities and highest (about $1.35) in two West Coast cities. In most cities, elevator operators (both men and women) had approximately the same average earnings as housemen or lobby cleaners.

Average hourly earnings of men room clerks ranged from $1.12 in Kansas City to $1.77 in San Francisco in 1955. The relatively few women room clerks had somewhat lower wages, on the average, than men clerks. Key, mail, and information clerks are usually paid lower salaries than room clerks.

Hotel employees usually worked a 40-hour week in northern cities and a 48-hour week in southern cities, according to the 1955 survey. Workers in a few cities had 37½-hour weekly schedules. Since hotels are open round the clock, workers may be employed on any one of three shifts, beginning early in the morning or in midafternoon or at midnight. Staffs are usually smaller on night than on day shifts, and additional compensation may be paid for work during late hours. Managers and housekeepers who live in the hotel usually have regular work schedules but may be on call 24 hours a day, 7 days a week.

Cooks, pantry workers, dishwashers, and other kitchen help commonly receive two free meals a day; in a few hotels, maids, elevator operators, and room clerks also receive free meals while on duty. A large majority of workers in 19 cities received a week's vacation with pay after 1 year of service and 2 weeks after 3 or more years. Paid holidays most commonly ranged from 2 to 6 days in mid-1955. Life insurance, hospitalization, and surgical insurance plans, financed partly by employers, are frequently provided hotel workers.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed staffs, such as bellmen and elevator operators, may be members of the Building Service Employees International Union.

Where To Go for More Information

Information on jobs in hotels may be obtained directly from personnel departments of hotels.

Information on career-type positions in hotels may be obtained from:

American Hotel Association,
221 West 57th St., New York 19, N.Y.

Additional information on training opportunities, and a directory of schools and colleges offering courses in the hotel field may be obtained by writing to:

The National Council on Hotel and Restaurant Education, 777 14th St., NW., Washington 5, D.C.

Information on housekeeping in hotels, including a list of schools offering courses in housekeeping, may be obtained from:

National Executive Housekeepers Association,
Statler-Hilton Hotel, Boston 17, Mass.

Information on courses relating to hotel work may be obtained from the local Director of Vocational Education, the Superintendent of Schools in the local community, or the State Director of Vocational Education in the Department of Education in the State capital.

Bellmen and Bell Captains

(D.O.T. 2-22.11; 2-22.01)

Nature of Work

Bellmen, also called bellboys or bellhops, carry baggage and perform a variety of other services for hotel guests. After a guest has registered, a bellman obtains the room key, takes the guest to his room, and deposits his baggage. The bellman checks the lights and the supply of towels and soap, and sees that everything is in order in the room. He may suggest the use of various hotel services, including the dining room and the valet service. Bellmen also deliver packages and perform other errands for guests. In large hotels, special baggage porters are usually employed to carry baggage for guests who are checking out. In smaller hotels, bellmen carry baggage for outgoing as well as incoming guests and may also relieve the elevator operator or switchboard operator.

Bellmen carry luggage for hotel guests and may give information on dining facilities, valet, and other hotel services.

Bell captains are employed in large hotels and many medium-size ones, to supervise the bellmen. They assign work to these employees, keep their time records, and instruct new bellmen in their duties. In addition, they handle complaints from guests regarding the work of their department, and take care of unusual requests for service. They may also help guests arrange for transportation by giving them information on train and plane schedules and sending a baggage porter or a bellman to pick up the transportation tickets. At times, bell captains may also perform the duties of bellmen.

Training and Other Qualifications

Bellman jobs are filled, in many hotels, either by promoting men employed as elevator operators or by hiring experienced bellmen from the outside. Some hotels, particularly the smaller ones and resort hotels, hire inexperienced young men as bellmen.

Young men seeking work as bellmen may apply to personnel departments of hotels in their own community, where their knowledge of the local area will be helpful in giving guests information.

Applicants are often referred to bell captains for an interview. Work and character references of job applicants are carefully checked prior to hiring. Since bellmen are in frequent contact with the public and have access to their personal belongings, it is important that they be honest, neat, tactful, and courteous. They must also be able to be on their feet all day and to carry heavy baggage.

No specific educational requirements exist for bellman jobs. However, courses covering bellman work, which are offered by a small but growing number of trade and vocational schools, are generally helpful in obtaining jobs. Graduation from high school is also valuable because outstanding bellmen with this educational background may be transferred to front office clerical jobs, which offer better opportunities for promotion. (See statement on front office clerks.)

In the service department of the hotel, the line of promotion is from bellman to bell captain to superintendent of service. Some of the factors which may affect a bellman's chances for advancement are a favorable work record showing a minimum of complaints by guests, good work habits, and leadership qualities necessary in supervisory positions. Since there is only one bell captain's position in each hotel, it may take a number of years before an opening occurs. A limited number of opportunities also exist for advancement to the position of superintendent of service. Men in this job—which is found in only a few hotels with large service departments—supervise elevator operators and starters, doormen, and washroom attendants, as well as bellmen.

Employment Outlook

A few thousand openings for bellmen are expected each year during the early 1960's. Most of these openings will arise from turnover, primarily because of the need to replace students and other young men who do not plan to remain bellmen for a long period of time and who will find it fairly easy to obtain other jobs as long as economic conditions remain favorable. Since a promotion-from-within policy is followed by many hotels in advancing men from elevator operator to bellman jobs, chances for outsiders to enter as bellmen will be best in resort hotels, in hotels which employ women as elevator operators, and in the increasing number of hotels with automatic elevator installations. Vacancies for beginners will also arise in small hotels, as experienced bellmen shift to jobs in better hotels where earnings from tips may be higher. Competition among employed bellmen for the relatively few bell captain jobs that will become available in the future is expected to remain keen.

Only slight growth in employment of bellmen is likely in the long run. Some jobs will arise in the new hotels that will be built and from additions to existing hotels. The fast growing motel field will also provide some new jobs; however, because of the type of construction and the emphasis on informality, motels require relatively few bellmen.

(See introductory section to this chapter for information on Where Employed, Earnings and Working Conditions, Where To Go for More Information, and for additional information on employment outlook.)

Front Office Clerks

(D.O.T. 1-07.)

Nature of Work

Most hotels employ one or more front office clerks whose chief duties are to greet guests, rent rooms, handle mail, and perform other duties related to the assignment of rooms. Working "up front" in hotel lobbies, they deal directly with the public and help build a hotel's reputation for courteous and efficient service. In small hotels and in motels, a front office clerk (who may be the owner) may not only rent rooms, issue keys, sort mail, and give information but also perform some bookkeeping work and act as cashier. On the other hand, large hotels may employ several front office clerks, each with a few specific duties.

Room or desk clerks (D.O.T. 1-07.60), mostly men, have the responsible job of renting rooms and usually are the first of the front office clerical staff to greet guests. They must try to fill any special requests for room accommodations made

Room clerks check reservation lists and assign rooms to hotel guests.

by guests, being careful that the rooms they assign will satisfy guests as well as yield maximum revenues for each section of the hotel. Room clerks also see that guests fill out hotel registration forms properly and may explain hotel rates and the types of services available. After registration is completed, room clerks signal bellmen to carry guests' luggage. *Key clerks* (D.O.T. 1–07.20) issue and receive room keys. *Reservation clerks* (D.O.T. 1–07.50) acknowledge guests' room reservations by mail or telephone, type out registration forms, and notify the room clerk when guests are due to arrive. To keep room assignment records current, *rack clerks* (D.O.T. 1–07.40) insert or remove forms indicating when rooms become occupied or vacant or when they are closed for repairs. They also keep housekeepers, telephone operators, or other personnel informed about changes in room occupancy. Other special clerks, such as *mail and information clerks*, are employed in some hotels. In the largest hotels, *floor supervisors* or *floor clerks* (D.O.T. 1–07.10) are assigned on each floor to handle the distribution of mail and packages and perform other incidental duties.

Front office clerks on late evening shifts, when demands for service are less frequent, often have added duties. For example, the night room clerk may perform bookkeeping functions or assist cashiers with their clerical work.

Training and Other Qualifications

High school graduates who have some clerical aptitude and the personal characteristics necessary for dealing with the public may be hired in such beginning jobs as those of mail, information, or key clerk. Neatness, a courteous and friendly manner, and ease in dealing with people are important personal traits for front office clerical workers. Men are generally preferred as room clerks and, in some hotels, even for less important front office work, because people in these jobs are usually considered in training for managerial posts which are held mainly by men. Typing and bookkeeping courses given in high school may be helpful, particularly for combination type jobs found in smaller hotels, or for night-shift work where additional clerical duties are often performed. Although education beyond high school is not generally required for front office work, hotel employers are placing increasing emphasis on college training in selecting personnel, who may later be advanced to managerial positions. Front office clerks may improve their opportunities for promotion by taking home study courses, such as those sponsored by the American Hotel Association through the American Hotel Institute.

Regardless of their educational background, most people start out in the more routine front office jobs. Sometimes, outstanding employees in other types of hotel work—for example, bellmen or elevator operators—may be transferred to such front office jobs.

Inexperienced front office workers learn mainly through on-the-job experience. However, they usually have a brief initial training period during which their duties are explained and background information is given about the hotel. They need a detailed knowledge of the location of hotel rooms and the types of services offered in order to assist guests. After new employees begin work, they receive help when necessary from the assistant manager or some experienced front office worker.

Most hotels have a promotion-from-within policy for front office workers. Advancement depends on the individual's personal characteristics, his on-the-job performance, and, of course, on the number of openings that arise. A typical promotion ladder might be from key or rack clerk to room clerk, to assistant front office manager, and later to front office manager. Further opportunities exist for promotion to top managerial posts which usually require many years of hotel experience. (See statement on hotel managers and assistants.)

Employment Outlook

A limited number of openings for front office clerks will probably arise each year during the early 1960's. Most of the openings in this relatively small occupational group will be in beginning jobs which become vacant as a result of promotions. Some new jobs will become available in cities where new hotels will be built or existing ones expanded. In addition, a number of front office jobs will become available in the hundreds of highway hotels and large motels that will open for business in the years ahead, as highway travel continues to increase.

Hotel employers will continue to hire women in a few front office jobs such as those of mail and information clerk and reservation clerk—a practice which arose largely when manpower shortages developed during World War II. However, women's chances for advancement to room clerk jobs and to managerial posts will probably remain limited, since men are still preferred in these jobs. Women will find somewhat better opportunities in resort hotels.

Front office clerks have relatively stable employment, compared with workers in many other industries. Furthermore, employment in this occupation is not likely to expand or contract as sharply with changes in general economic conditions as employment in many other hotel occupations.

(See introductory section to this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information and for additional information on employment outlook.)

Housekeepers and Assistants

(D.O.T. 2–25.21, .22)

Nature of Work

Hotel housekeepers are mainly responsible for keeping guest rooms, meeting rooms, halls, and lobbies clean and attractive. They supervise the activities of maids, housemen, and other employees in their department—which is, in many instances, the largest department of the hotel. They generally hire and discharge employees, help train new ones, keep employee records, and perform other duties which vary with the size and type of the hotel. Of the approximately 20,000 women hotel housekeepers reported in the 1950 Census, the majority were employed in small hotels where housekeepers not only supervise the cleaning staffs but perform some of the work done by maids. On the other hand, in large hotels and smaller luxury-type hotels, the duties of the executive or head housekeeper are primarily administrative. Besides supervising a staff which may number in the hundreds, she may prepare the departmental budget; make regular reports to the manager on the condition of rooms, needed repairs, and suggested improvements; purchase or assist in purchasing supplies; take periodic inventories; and have responsibility for interior decorating work. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up a housekeeping department in a newly acquired hotel.

In many hotels, executive housekeepers are assisted by floor housekeepers who directly supervise the work on one or more floors. In large hotels, there may also be an assistant executive housekeeper. The number and types of workers in the housekeeping department depend, of course, on the size and kind of hotel. In some, the housekeeper supervises not only maids and housemen (who do the heavy cleaning and move furniture) but also a variety of specialized workers such as seamstresses, draperymakers, upholsterers, furniture refinishers, painters, and carpenters.

Housekeeper supervising the work of a seamstress.

Training and Other Qualifications

Positions as executive housekeepers in hotels are usually filled either by promoting assistant or floor housekeepers, or by hiring mature women who have performed similar work in other hotels or institutions such as hospitals. Maids and linen room attendants who have proved their ability by on-the-job performance and who have the personal characteristics necessary for supervisory jobs are considered for jobs as floor or assistant housekeepers. They must have a thorough knowledge of cleaning supplies and equipment and of the various housekeeping duties in order to organize work efficiently and to train new employees. The executive housekeeper must qualify not only in housekeeping work but also in areas such as budget preparation, purchase of equipment and supplies, and sometimes interior decorating work. Although employment as a housekeeper in a private household provides useful background, it does not generally qualify an individual to take over a job as hotel housekeeper.

No specific educational requirements exist for housekeepers but individuals may improve their opportunities for advancement by taking courses given by some public vocational schools or private schools specializing in training hotel workers. In addition, a few colleges give specialized training in hotel management, including courses in hotel housekeeping. Some universities offer short courses during the summer or conduct evening classes in cooperation with the National Executive Housekeepers Association. Probably the most helpful courses are those stressing housekeeping procedures, personnel management, interior decorating, and the use and care of different types of equipment and fabrics. Qualified women who have special educational backgrounds may be hired directly for lower supervisory positions.

Employment Outlook

Several hundred openings for housekeepers and their assistants are expected each year, in the early 1960's. Most openings are expected to result from the need to replace housekeepers who retire, die, or withdraw from the occupation. A relatively large number of vacancies will occur because many housekeepers are near retirement age. Some openings for housekeepers will also arise in the new city hotels that will be established, as well as in the growing number of large luxury motels and highway hotels that will be built to keep pace with the anticipated expansion of automobile travel. In addition, assistant housekeepers will be needed to replace those who are promoted or to fill new positions in hotels that increase their room capacity. Opportunities to gain the practical experience for housekeeping jobs will be plentiful, since many thousands of jobs will become available each year in the large occupation of maid. However, it should be noted that since only one top job as housekeeper exists in each hotel, it may take many years before an opening occurs in a particular hotel.

Opportunities for women in the older age groups to become housekeepers will continue to be good in the years ahead. Housekeepers have relatively stable employment, and employers, aware of the valuable experience acquired by their housekeepers, will generally allow them to keep on working past normal retirement age.

The best opportunities in this occupation will arise for women with administrative ability, specialized training in hotel housekeeping procedures, and a flair for interior decorating work. Housekeepers with hotel experience will also find employment opportunities in hospitals, clubs, college dormitories, and a variety of welfare institutions.

(See introduction to this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on employment outlook.)

Managers and Assistants

(D.O.T. 0–71.13, .15; 0–97.63)

Nature of Work

Hotel managers have overall responsibility for successful hotel operations. Within the framework of policy set by owners or boards of directors, they direct and coordinate the activities of the front office, kitchen and dining room, and the various departments such as housekeeping, service, accounting, personnel, purchasing, publicity, and maintenance. They make decisions on room rates, establish credit policy, introduce improvements in operations, and assume final responsibility for settling guests' complaints. In their capacity as hosts, managers guide their staffs so as to bring about maximum satisfaction to guests at a cost which will bring the greatest profit to owners. They may also spend considerable time conferring with business and social groups and participating in community affairs, in order to increase their hotel's business.

In small hotels, the manager may perform much of the front office clerical work in addition to his administrative duties. In the smallest hotels and in many motels, the owners—sometimes a husband-and-wife team—manage the business alone.

The general manager of a large hotel may have several assistants, each assigned an area of responsibility. An executive assistant may be employed to manage one or more departments and to take over general administrative responsibility when the manager is absent. Because food preparation and service is such an important part of the operation of most large hotels, a special manager is usually in charge of this area. (See chapter on Restaurant Occupations.) Managers of large hotels usually also employ a special assistant, known as sales manager, whose job is to promote maximum use of hotel facilities. Much of the sales manager's time is spent traveling about the country explaining to various groups the facilities his hotel can offer for meetings, banquets, and conventions.

Since large hotel chains often centralize certain activities such as purchasing supplies and equipment and planning employee training programs, managers of these hotels may have fewer different duties than managers of large independently owned hotels. In hotel chains, managers may be assigned on a temporary basis to help organize work in a newly acquired hotel, or they may be transferred to established hotels in different States or in foreign countries.

Training and Other Qualifications

Managerial positions are usually filled by experienced men who have come up from the ranks as a result of the promotion-from-within policy followed by most hotels. Individuals who have proved their ability, usually in front office jobs, may be promoted to assistant manager positions and eventually to general manager.

Although hotel experience is an important re-

Hotel manager checking the arrangements for a large banquet.

quirement, employers are placing increasing emphasis on selecting managers with a college degree. Many employers believe the best educational preparation is that obtained in the few colleges in the country which offer a specialized 4-year curriculum in hotel administration, including study in the field of food management. Specialized courses in hotel work, available in a few junior colleges, and home study courses given by the American Hotel Institute are helpful.

In the colleges offering a specialized 4-year curriculum in hotel management, the courses cover a wide range of subjects including hotel administration, hotel accounting, economics, food service management and catering, and hotel engineering (plumbing and heating systems, refrigeration, and electrical equipment). In addition, students may study foreign languages and are encouraged to enroll in courses of cultural value such as history, philosophy, and literature. They must also spend three summers working in hotel or restaurant jobs—for example, as busboys or bellmen, room clerks, or sometimes even assistant managers. The experience and contacts with employers gained in these jobs may enable young people to obtain better hotel positions after graduation.

Young men with specialized training often start in front office clerical jobs but, as a rule, are advanced to assistant managerial posts more rapidly than clerks with less formal training. It usually takes a number of years of experience to advance to top managerial positions. An increasing number of employers are requiring some experience in food operations. Chances for advancement may be somewhat better in hotel chains than in independent hotels, since persons may be selected to fill vacancies which arise in any hotel in the chain as well as on the central management staff.

Company training programs for managers are a recent development in hotels. Some large hotels have established special programs for management trainees who are college graduates or for less highly trained personnel promoted from within. Such programs consist mainly of on-the-job training assignments in which the trainee is rotated among jobs in the various hotel departments. In addition, some large hotels provide financial assistance to outstanding employees for college study.

Employment Outlook

Opportunities for employment in manager-trainee jobs in hotels are expected to be good during the early 1960's. Nevertheless, there will be keen competition for the relatively few managerial positions that become available each year in large hotels. Most of the openings for general managers will result from retirements and deaths, although some new positions will arise in the new city hotels that will be built, and in the growing number of large luxury motels and highway hotels. A somewhat greater number of assistant managers will be needed to fill vacancies that may arise from promotions or from resignations of people who leave the field, and to fill additional jobs in hotels that increase their room capacity as well as in those newly constructed.

In the long run, there will probably be a moderate increase in the number of managers employed. However, competition will continue to be keen for the one or more positions that may open up over a period of years in each hotel which employs managers. Young men with college degrees in hotel administration will probably have the best chances for advancement to top positions, particularly if they can handle food management and can qualify as sales managers.

Managers generally have stable employment. However, during a prolonged economic downturn, some assistant managers might be dropped.

(See introductory section to this chapter for information on Where Employed, Earnings and Working Conditions, Where To Go for More Information, and for additional information on employment outlook.)

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

The industrial chemical industry has developed, in just a few decades, into one of the great manufacturing industries in the country. The public is generally unaware of the millions of tons of industrial chemicals produced yearly because most of these chemicals never reach the consumer in the same form in which they leave the factory. This industry, however, is one of the Nation's largest material suppliers; its products are used as raw materials or as processing agents by almost every manufacturing industry. The industry manufactures thousands of chemicals ranging from sulfuric acid and chlorine to rayon and synthetic rubber. It also has an important defense role, since the manufacture of armaments, munitions, and rocket fuels requires many types of industrial chemicals.

In 1958, more than 400,000 wage and salary workers were employed in the industrial chemical industry in a wide range of occupations. Training requirements vary from graduate college degrees for some scientists to a few days of on-the-job training for some of the less skilled plant workers.

Nature of the Industry

Industrial chemicals are produced primarily for use by other industries for further manufacturing. They are distinguished from other chemical products, such as drugs and fertilizers, which go directly to the consumer without additional processing. The industry is made up of plants which manufacture basic industrial inorganic and organic chemicals.

Industrial organic chemicals are derived from once-living matter such as coal, petroleum, natural gas, and agricultural and forest products. Some products of organic chemicals, such as synthetic fibers (rayon, nylon, and orlon), synthetic rubber, and plastics materials are well known. Those less well known to the public include dyes and other color pigments, industrial alcohol, formaldehyde, industrial explosives, benzene, and glycerin. Among the principal users of organic chemicals are the textile, plastic products, and food processing industries which convert organic chemicals into consumer products.

Inorganic chemicals are derived from nonliving matter such as salts, sulfur, mineral ores, limestone, and water. The products of inorganic chemicals are used in almost every manufacturing industry as raw materials or as processing agents. Inorganic chemicals are basic ingredients used in the manufacture of steel, glass, paper, plastics, and thousands of other products in everyday use. Much of the output is used by the chemical industry itself in manufacturing other chemical products. Sulfuric acid is the most widely used industrial inorganic chemical and important consumers of this product are the fertilizer and petroleum industries. Nitric acid is also important as a basic raw material in manufacturing explosives, plastics, paints, and solvents. Other important inorganic chemicals are phosphoric acid, essential in the rustproofing of steel; hydrochloric acid, used for removing rust from steel prior to plating, and for manufacturing plastics and other chemicals; and soda ash, used in the manufacture of glass, medicines and drugs, detergents, soap, and other cleaning products.

The more than 1,200 plants making industrial chemicals are distributed throughout the country with at least 1 plant in nearly every State. A number of factors determine the location of these plants. To minimize transportation costs, establishments making heavy inorganic chemicals are often built near the source of raw materials. For example, plants producing salts and alkalies are near large underground deposits of salt, like those in Louisiana or in some parts of the Northeast; and plants producing chemicals made from petroleum and natural gas are near the oilfields of Texas, California, and Louisiana. Other types of chemical plants are constructed near the users of their products. The availability of cheap and abundant electric power and water supplies are also factors in deciding plant location. In addition, because of the large amount of space required for plants and the problem of disposal of waste products and gases, many plants are in rural areas or on the outskirts of industrial centers.

Although industrial chemical workers were employed in plants in every State, over two-thirds were in 10 States, with the largest numbers employed in Tennessee, New Jersey, and Texas. Other States in which large numbers of industrial chemical workers were found were New York, Virginia, West Virginia, Pennsylvania, Michigan, Ohio, and Delaware. (See chart 40.)

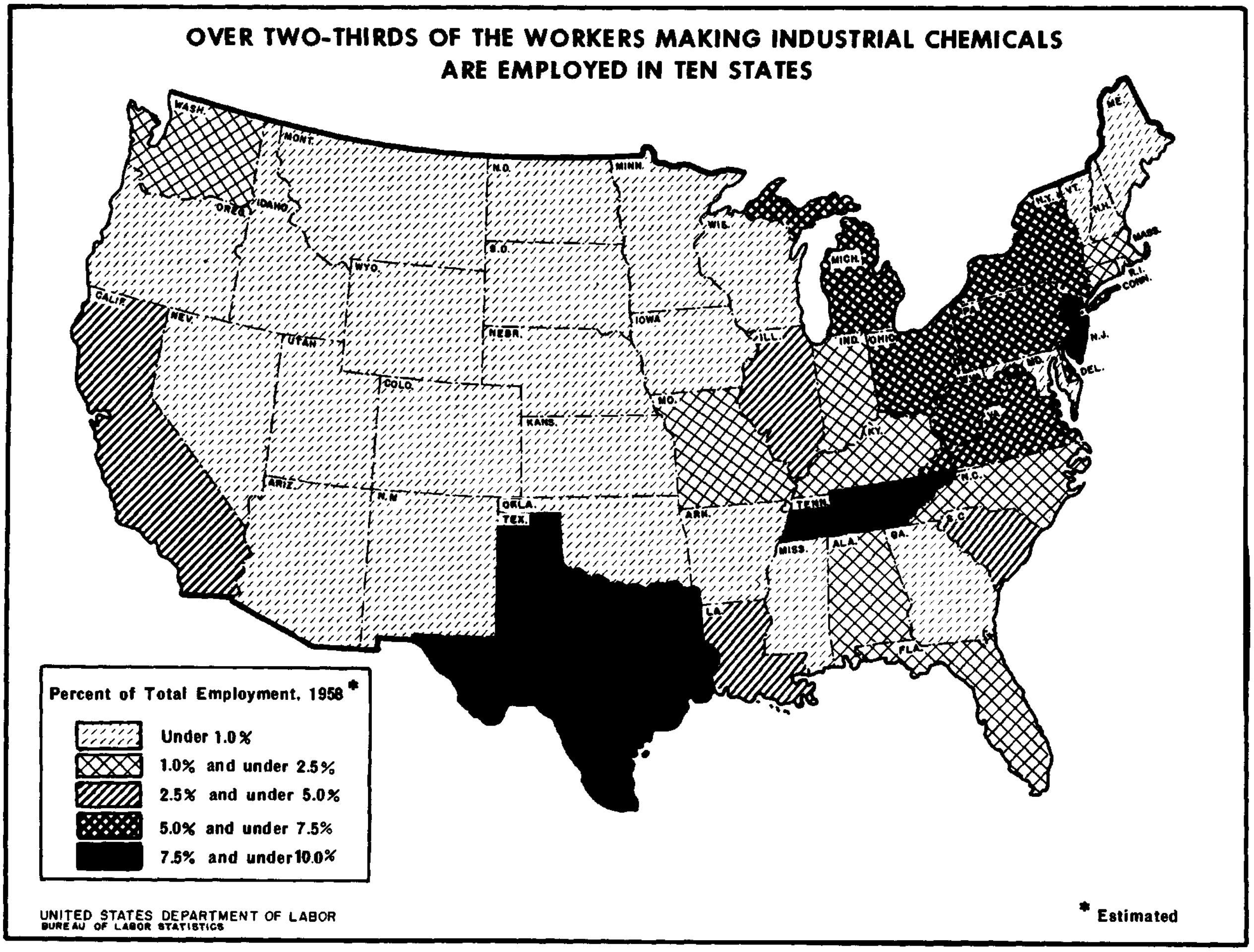
Methods of manufacturing the thousands of industrial chemicals are as varied as the products made. A description of the processes in manufacturing any one chemical would not be representative of the industry as a whole since different processes are used to make different chemicals. A few generalizations, however, can be made to illustrate certain basic processes that may be considered typical, enabling the reader to understand the types of jobs found in this industry.

Industrial chemicals are made by changing raw materials through both chemical and physical processes. Through chemical changes, new compounds are formed from these raw materials by combining various chemicals, by breaking down chemical compounds, or by building them up to more complex forms. Some of the physical processes are grinding, mixing, evaporation, drying, filtration, absorption, and distillation. Several types of equipment or methods can be used to perform each operation. For example, solids may be separated from liquids by filtration, by centrifugal force, or by settling.

Most chemical plants, especially those making inorganic chemicals such as acids or alkalies, have a vast network of pipes. These pipes are necessary for intraplant transfer of chemicals which are mainly in liquid or gas form during processing. Generally, large volume production methods are used with minimum handling of materials by workers.

Many chemicals are manufactured in large reactors (kettles) in which raw materials are com-

CHART 40



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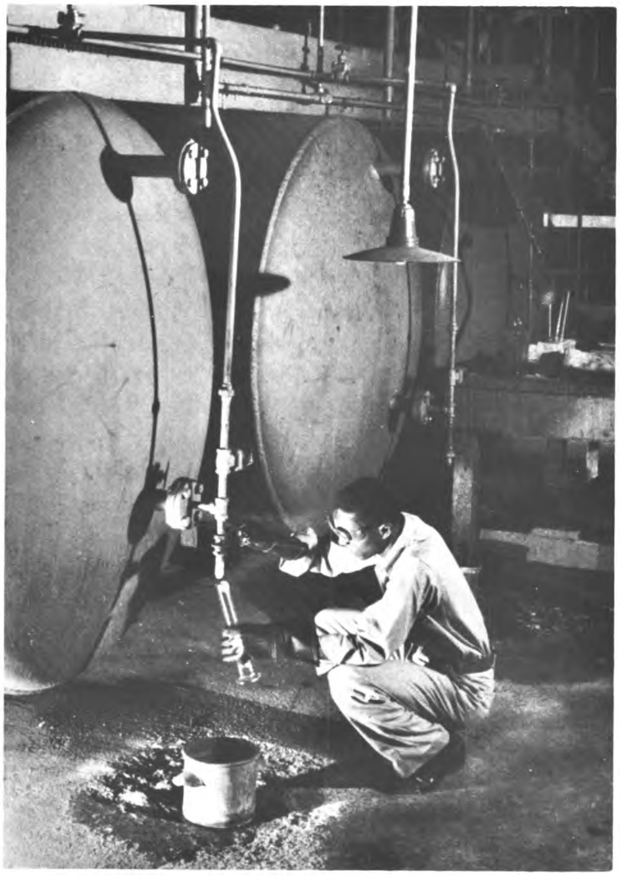


Chemical operator drawing off samples of a chemical for testing in the laboratory.

bined or separated. Often, chemicals must pass through several reaction operations to produce the desired end product. Chemicals flow from one reactor to another through the network of pipes. Throughout both the processing operations and the transference of chemicals between operations, automatic control devices usually regulate the flow of materials, the combination of different chemicals, and the temperature, pressure, and time in each operation. Automatic control devices make it possible to combine several different operations into a single continuous operation with a minimum of manual handling.

Occupations in the Industrial Chemical Industry

Workers with many different levels of skill and education are employed in the plants, offices, and laboratories in industrial chemical firms. By far the largest proportion of employees (about two-thirds) work in plant occupations. The operations of the industry make it dependent upon a large number of technical workers, including chemists; chemical, mechanical and electrical engineers; laboratory assistants; and draftsmen. Many different types of administrative and related personnel, such as purchasing agents, accountants, personnel officials, and salesmen, are also employed as well as many clerks, stenographers, bookkeepers, typists, and other officeworkers.

In October 1958, nearly 52,000 women worked in industrial chemical plants, mainly in such office jobs as bookkeepers, clerks, stenographers, and office machine operators. In the plants, they usually work as laboratory assistants or packers. In some plants, they are employed as chemical operators. Some women also work in the research laboratories as analytical and research chemists.

Plant Occupations. Chemical plant workers can generally be divided into three major occupational groups: production workers who operate the chemical-processing equipment; maintenance workers who maintain, install, and repair machinery, pipes, and equipment; and other plant workers, such as stock clerks, material handlers, truckdrivers, and others not included in the first two groups.

Process equipment operators and their helpers are the largest occupational group in the industrial chemical industry. Many of these operators are skilled workers. *Chemical operators* (D.O.T. 4–52.770 and 6–52.770) operate one type of equipment or direct a chemical process utilizing several types of chemical equipment to produce final or intermediate chemical products in accordance with prepared specifications. Their duties are relatively similar regardless of the type of equipment they operate. Some skilled chemical operators measure the proper quantities of materials to be processed according to formulas or specifications prepared by a chemist. They set and regulate the controls for temperature, pressure or flow of materials. They also keep a running record of the quality of the operation and report any sign of breakdown or variation from the specifications. They may use measuring and testing instruments or, occasionally, they may send samples of the material to the testing laboratory. Chemical operators are responsible for carrying out instructions of the chemists concerning the quality and quantity of the product. They may be assisted by other chemical operators of less skill as well as by helpers.

Some chemical operators are designated according to the type of equipment they operate. For example, *stillmen* (D.O.T. 4–51.635 and 6–51.630) operate the distillation equipment that separates compounds into component parts. *Autoclave operators* (D.O.T. 4–52.711) operate high-pressure vessels, called autoclaves, in which the reaction involves chemical changes within highly critical pressure and temperature limits. *Evaporator men* (D.O.T. 4–51.755) operate equipment that concentrates chemical solutions by removing part of the water content. Since different processes are used to make the many types of chemicals, the kinds of chemical operators vary from plant to plant. For instance, the autoclave operator, one type of chemical operator in plants making alkalies and chlorines, may not be employed in a plant making other chemical products.

In addition to the chemical process operators, other production workers operate the physical process equipment that prepares the raw materials for further processing. They tend the various machines which produce such physical changes as the breaking down and refining of chemicals. For example, *grinders* (D.O.T. 6–52.751) operate machines which reduce the size of solid particles and which screen the resultant powder to meet laboratory specifications. *Filterers* (D.O.T. 6–51.855 and .870) operate one or more units of filtering equipment used in separating suspended solids from liquids. *Driers* (D.O.T. 6–51.820) operate one or more units of equipment used in separating water or other liquid components from solids. *Mixers* (D.O.T. 6–51.926) operate one or more machines in which component parts (liquids or solids) are blended or mixed in controlled amounts.

Because industrial chemical manufacturing requires a large amount of complicated equipment and because high temperatures and pressures greatly increase the wear on this equipment, the industry employs a large number of maintenance workers. Important maintenance occupations include *pipefitters* who lay out, install, and repair pipes and pipefittings; *carpenters* who construct and maintain the woodwork and equipment such as doors, partitions, and floors; *maintenance machinists* who make and repair metal parts for machines and equipment; and *electricians* who maintain and repair wiring, motors, switches, and other electrical equipment. In addition, this industry employs many highly skilled *instrument repairmen* who install and repair the vital electric and electronic instruments which regulate, record, and control the flow of chemicals in many manufacturing processes. The job of instrument repairman is a relatively new specialization in the chemical industry and has become increasingly important because of the growing use of automatic controls in chemical processing. In some instances, maintenance jobs may be combined into a single job involving general maintenance mechanic duties. (A detailed discussion of the duties, training, and employment opportunities in maintenance jobs appears elsewhere in this Handbook. See index for page numbers.)

Chemical operator regulating controls for temperature, pressure, and flow of chemicals.

Plant workers who do not operate or maintain equipment perform a variety of tasks in industrial chemical plants. Some workers drive trucks and tractors making deliveries to various parts of the plant; some load and unload materials on trucks, trains, or ships; and other workers keep inventory records of stock and tools. The industry also employs custodial workers such as guards, watchmen, and janitors whose jobs are similar to those in other industries.

Technical Occupations. Because of the highly technical nature of its operations, the industrial chemical industry employs many persons with chemical, engineering, or other scientific backgrounds. A large proportion of these personnel are employed in the industry's research activities to develop new chemical products and new methods of production. According to a 1956–57 Bureau of Labor Statistics survey of research and development manpower in American industry prepared for the National Science Foundation, more than 10 percent (almost 80,000) of the Nation's engineers and scientists were employed by all types of chemical firms. More than one-half of these employees worked for industrial chemical firms.

This industry is one of the principal employers of chemists and chemical engineers. *Chemists* are engaged in a number of different functions. Many work in research laboratories. A large number are employed in production departments where they control the quality of the product being manufactured by supervising the testing of materials during processing. Some chemists work as supervisors of plant workers. Others work as technical salesmen, technical writers, or in administrative positions requiring technical knowledge.

Laboratory technician testing samples.

Chemical engineers are concerned with the application of chemistry and engineering to the design, construction, operation, control, and improvement of chemical equipment and plants. They convert processes developed in a laboratory into large-scale production methods, using the most economical manufacturing techniques. Some chemical engineers are employed in production jobs as well as in jobs which are customarily held by chemists.

Several other types of engineers are also employed in industrial chemical firms. *Mechanical engineers* design and lay out plant equipment, and plan the central distributing system for heat, gas, water, or steam. *Electrical engineers* are concerned with instrumentation and control, and power generation and distribution. They also design and develop electrical and electronic machinery and equipment.

In addition to the large number of professional and technical personnel, the industry employs many technical assistants such as *laboratory technicians*, *draftsmen*, *engineering aids*, *chemical analysts*, and *production supervisors. Laboratory technicians* assist chemists and engineers in research and development work and in production control. They may perform simple routine tests or do highly technical, analytical work, depending on their training and experience. Much of the work of the laboratory technicians consists of conducting tests and recording the results—often in the form of simple reports, charts, or graphs for interpretation by the chemists and chemical engineers. (More detailed descriptions of the duties, training, qualifications, and employment outlook of chemists, engineers, technicians, and other scientific and technical occupations appear elsewhere in this Handbook. See index for page numbers.)

Administrative, Clerical, and Related Occupations. The industrial chemical industry employs a wide variety of administrative, clerical, and other white-collar personnel. A large number of the higher level administrative and management positions are filled by technically trained men, many of whom are chemists or chemical engineers. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, types of products to manufacture, and location of plants. To make such decisions, the executives require the help of a large body of specialized personnel. Some of the specialized workers in the field of administration are accountants, purchasing agents, sales representatives, lawyers, and personnel employed in such activities as industrial relations, public relations, transportation, advertising, and market research.

Other white-collar workers are required to assist these specialized administrative workers. For example, clerical employees keep personnel, payroll, raw materials, sales, shipments, and plant maintenance records.

Training, Other Qualifications, and Advancement

The industrial chemical industry generally hires inexperienced workers for processing jobs and trains them on the job. Companies in the industry usually prefer to hire young workers with some high school education.

In many plants, a new worker is assigned to a labor pool where he does such jobs as filling drums, moving materials, and helping skilled chemical operators. After working in the labor pool for several months, he may be transferred to a processing or maintenance department when a vacancy occurs. As he gains experience and know-how, he moves to the more skilled jobs in his department. He may advance from a job as a laborer to that of chemical operator helper and eventually may become a skilled chemical operator. Skilled process workers are rarely recruited from other plants.

Although maintenance jobs are sometimes filled by hiring experienced men, they are generally filled by men trained in the plant. Many industrial chemical companies have training programs to meet the needs of their maintenance shops. These programs may last a few months to several years and include mainly on-the-job training and some classroom instruction related to the trainee's particular work. Many companies encourage skilled maintenance workers, as well as trainees, to take courses related to their jobs in local vocational schools and technical institutes, or to enroll in correspondence courses. Upon the successful completion of these courses, some companies reimburse the workers for part or all of the tuition.

A bachelor's degree in chemistry, engineering, or mathematics from a recognized college is usually the minimum educational requirement for scientists and engineers. For research jobs, persons with advanced degrees are generally preferred. Some companies have formal training programs for young college graduates with engineering or scientific backgrounds. These men work for brief periods in the various plant-operating divisions to gain a broad knowledge of chemical manufacturing operations before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research, operating, or maintenance unit.

Technicians employed by industrial chemical firms have qualified for their jobs in many different ways. Not all persons who work as technicians are specifically trained for their occupations. Engineering or chemistry dropouts; graduates and dropouts of liberal arts colleges, especially those with some chemistry, mathematics, or other scientific training; and other persons who have received post-high-school education often become technicians. A person may become a technician by studying at a technical institute or vocational school. Many technical institutes offer 2-year programs which will qualify a person as a laboratory assistant. Workers may also qualify as technicians through experience only. Some industrial chemical firms have programs to train draftsmen and laboratory technicians. Laboratory assistants begin their work in routine jobs and advance to positions of greater responsibility after they have acquired additional experience and demonstrated their ability to work without close supervision. Inexperienced draftsmen usually begin as copyists or tracers. With additional experience and training, workers may advance up the job ladder to more skilled and responsible drafting positions.

Administrative positions are frequently filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. Some companies have advanced training programs in which they give their new employees additional training in their specialties. Most industrial chemical firms employ persons who have had commercial courses in high school or business schools as clerks, bookkeepers, stenographers, and typists. Although the qualifications for and the duties of administrative, sales, clerical, and related occupations are similar in this industry to those in other industries, a knowledge of chemistry is sometimes helpful. This is especially true of sales jobs where it is often necessary to give customers technical assistance.

Employment Outlook

The industrial chemical industry is expected to provide thousands of job opportunities for new workers during the 1960's. Many of these openings will result from the expected expansion of the industry. Industrial chemical employment is expected to increase at a faster rate than the estimated 20-percent increase for the Nation's total working population. The need to replace those workers who retire, die, or transfer to other fields of work will also provide many job openings for new workers.

The industrial chemical industry is one of the Nation's most rapidly growing manufacturing industries. It is a major supplier of raw materials to almost every other industry and, therefore, its future growth is directly related to the general expansion of the economy.

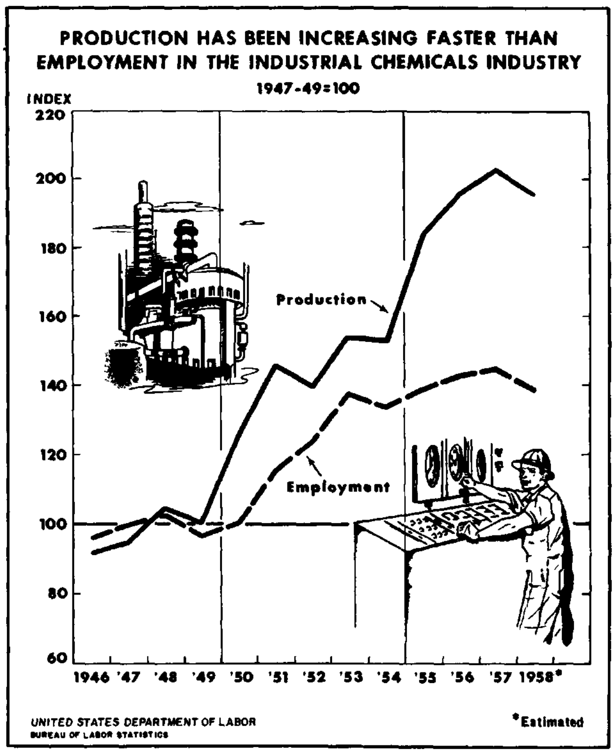
Although the industrial chemical industry has made amazing progress in the past, it has vast potential for further development from its research activities. This dynamic industry has far outstripped most other major industrial groups in rate of growth and in the development of new products. Some of these products have created completely new markets. Others, like plastics and synthetic fibers, have competed successfully in markets previously dominated by wood, natural textile fibers, and metals, and are expected to continue to make inroads in these markets. A plentiful supply of the raw materials used in chemical manufacturing is also favorable to the industry's future growth. The development of atomic energy is another factor of potential growth for this industry. New chemicals will be required for the manufacture of radioactive materials. Furthermore, radioactive elements hold promise for new products to be made by chemical processes not yet developed.

The new products and new methods of production, which are typical of the industry, are the results of its emphasis upon research and development. The industry's expenditures for research and development are among the highest in American industry.

Between 1939 and 1958, there was a sevenfold increase in the output of industrial chemicals, and employment nearly tripled. Although a continued expansion in production is anticipated through the 1960 decade, employment is expected to increase at a much slower rate than production. This has been the industry's experience for many years. For example, output more than doubled in the 1947–58 period, whereas employment rose two-fifths. (See chart 41.) Widespread use of automatic processing and control equipment has enabled the industry to increase its production with a relatively small addition of labor. Despite the anticipated technological progress in this industry in the next decade, expansion of output will probably result in increased employment above the 1958 level.

Although all major occupational groups are expected to grow, some will increase at a faster rate than others. The number of technical and administrative workers is expected to increase at a faster rate than the number of plant workers.

CHART 41



This will be a continuation of recent trends in this industry. In 1947, nonproduction workers made up about 22 percent of the industry's total employment compared with over 37 percent in 1958. Continued emphasis on research and development and greater complexity of products and processes are expected to increase the need for chemists, engineers, and technicians.

The largest relative increase in employment of plant workers will be in maintenance and repair occupations, such as instrument repairmen, pipefitters, electricians, and maintenance mechanics, because of the increasing use of instrumentation and automatic equipment in processing operations. Processing equipment operators will continue to be the largest occupational group in the industry, although employment of these workers is not expected to increase as much as the employment of maintenance and repair workers.

Employment opportunities will also arise from the need to fill vacancies created by retirement, death, or transfer of workers to jobs in other fields. Retirements and deaths alone will provide on the average about 7,000 to 9,000 openings for new workers each year during the 1960–70 decade.

Earnings and Working Conditions

Production workers in the industrial chemical industry are among the higher paid factory workers. In April 1959, workers employed in inorganic chemicals averaged $109.18 a week or $2.65 an hour; and those working in organic chemical plants averaged $104.39 a week or $2.54 an hour. This compares with the average weekly earnings of $89.87 or average hourly earnings of $2.23 for all manufacturing industries for the same period. Skilled maintenance workers and chemical operators generally had higher earnings than other factory workers.

Entry salaries for chemists and chemical engineers in the industrial chemical industry were among the highest in American industry, according to a 1958 survey conducted by the American Chemical Society. The survey showed that in this industry, the average starting salary for chemists with a bachelor's degree was $450 a month, and $480 a month for chemical engineers with a bachelor's degree. Chemists and chemical engineers with graduate degrees received higher starting salaries. Comprehensive earnings data for other engineers and scientists in this industry are not available. (A detailed discussion of earnings in individual professional and technical occupations are included elsewhere in this Handbook in the statements on these occupations. See index for page numbers.)

Paid vacations are universal in this industry and are generally based on length of service. Workers generally receive 1 week after 1 year of employment; 2 weeks after 5 years; and 3 weeks after 15 years.

A majority of the workers are covered by insurance plans. These plans include life, sickness, accident, hospitalization, and surgical insurance. Practically all the plants have pension plans.

Many chemical workers are employed in large continuous process plants that operate around the clock, 7 days a week, and three shifts a day. Owing to the widespread industry practice of rotating shifts, process workers can expect to work the odd shifts at one time or another. Virtually all plants pay a differential for shift work, usually 6 to 8 cents an hour for the second shift, and 10 to 12 cents an hour for the third or night shift. Relatively few maintenance workers are employed on the odd shifts. Work in the industry is subject to few seasonal variations and all regular workers have year-round jobs.

Working conditions vary with the type of job; the kind of equipment; and the size, condition, and age of the plant. In some plants, workers are exposed to dust, disagreeable odors, and extreme temperatures. Chemical companies, however, have made intensive efforts in recent years to reduce the discomforts arising from these conditions by the introduction of improved ventilating systems. Safety measures such as protective clothing, placard warnings in danger areas, the placement of showers and eye baths near dangerous work stations, and first-aid stations have also reduced hazards.

As a result of such measures, the injury-frequency rate for the industrial chemical industry is much lower than the average rate for all manufacturing industries. According to the Bureau of Labor Statistics, in 1957, the average number of disabling injuries was 4.4 for each million man-hours worked in industrial inorganic chemical plants, and ranged from 1.8 to 4.7 in the different segments of the industrial organic chemical industry. This compares with an average of 11.4 for all manufacturing industries.

With the exception of the work performed by laborers and material handlers, most industrial chemical jobs do not require heavy physical labor. Much of the plant work involves tending, inspecting, or maintaining machinery and equipment, since most of the processes are automatic or semiautomatic. Some workers climb stairs and ladders to considerable heights in the course of their duties. Other jobs are performed out of doors in all kinds of weather.

Most production workers in the industrial chemical industry are members of labor unions. The leading unions are: the International Chemical Workers Union; Oil, Chemical and Atomic Workers International Union; and District 50, United Mine Workers of America (Ind.).

Where To Go for More Information

Further information concerning jobs, processes, and working conditions in the industrial chemical industry can be obtained from the following sources:

Manufacturing Chemists' Association, Inc.,
1825 Connecticut Ave. NW., Washington 9, D.C.

International Chemical Workers Union,
1659 West Market St., Akron 13, Ohio.

INSURANCE OCCUPATIONS

Insurance is a vast and growing business, employing more workers than such great industries as automobiles, and telephone and telegraph. Both young inexperienced workers and mature people can find employment opportunities in this multibillion dollar business, which in 1958 employed about 900,000 persons.

Most adults own one or more insurance policies to protect them against loss from some of the many hazards to life and property. People can insure almost anything they consider valuable—from a prized personal possession, such as a rare book or a pet, to something on which earnings depend—for example, a ballet dancer's legs or a pianist's hands. However, the policies most commonly sold are those which insure life, dwellings, business plants, machinery, crops, automobiles, and other valuable possessions. People also pay into insurance plans to provide funds for retirement, sickness or disability, and the education of children. Insurance enables families and businessmen to conduct their affairs with the assurance that money will be available in emergencies, when it is most needed.

Another important aspect of the insurance business is its large-scale investment activity. The billions of dollars invested every year by insurance companies provide corporations with money to build new plants and to purchase equipment and machinery. Thousands of new homes for families have been financed through mortgages held by life insurance companies. Such huge investments stimulate economic activity and contribute to the Nation's growth, while at the same time, they provide interest income which is used to help meet the insurance costs and for other business purposes.

Nature of the Insurance Business

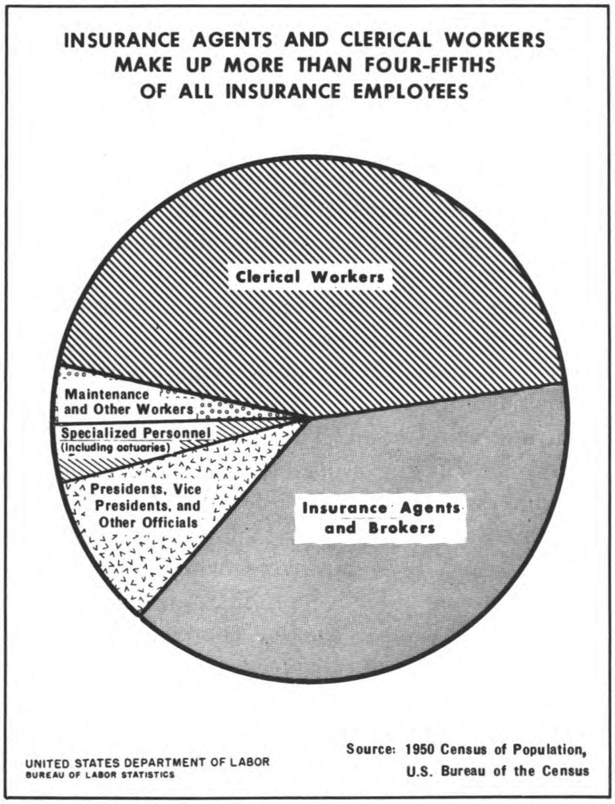
The insurance business has two major branches—life, and property and casualty—which employ about equal numbers of workers. Life insurance provides funds for the personal needs of individuals and families in case of death, retirement, or disability of the insured. Life insurance companies also sell accident and health insurance. Many kinds of special life insurance policies exist, such as those which give extra financial protection to families with young children or those which insure owners of large estates where inheritance and tax laws complicate insurance matters. Property and casualty insurance companies provide policies that protect owners against loss or damage to property from perils such as fire, hail, and windstorm. They also sell liability insurance, including workmen's compensation and automobile insurance. In addition, casualty companies sell fidelity bonds which protect employers against theft by employees who handle large sums of money. Under recently enacted legislation, property and casualty companies may sell most kinds of insurance, except life insurance, in a single policy. Casualty companies as well as life companies often sell accident and health insurance policies. These policies like pension and life insurance policies, may be sold on a group basis, covering the few employees of a small firm or the many thousands in a large corporation.

More than 1,300 life insurance companies and approximately 3,500 property and casualty insurance companies were in operation in 1958. Besides their main offices, commonly referred to as home offices, most of these companies have agencies throughout the country. The many thousands of insurance agencies are either maintained by insurance companies as branch offices or are operated by agents or brokers in business for themselves.

Insurance Workers

The work in company home offices is carried on by thousands of clerical workers and a relatively small number of professional employees under the direction of insurance executives. Clerical workers are the largest group of insurance workers, representing about 45 percent of the total number in 1950. (See chart 42.) About 10 percent of all insurance employees are executives—company presidents, vice presidents, department

CHART 42



heads, or other officials. About 4 percent are professional specialists, including accountants, lawyers, doctors, nurses, and engineers.

Some workers are in occupations unique to the insurance field—chiefly actuaries, home office underwriters, and claim adjusters. Actuaries, who usually have college degrees in mathematics, determine what classes of risks should be accepted and what rates should be charged in order to keep the insurance company financially sound. Home office underwriters make responsible decisions on whether to accept or reject insurance risks and select the appropriate premium rates. Although the life insurance agent may also be called a life underwriter, selling and home office underwriting are separate functions. Claim adjusters determine whether claims relating to injury, damage, or loss are justified and see that proper payment is made under the terms of insurance policies. Home office underwriters and claim adjusters receive considerable on-the-job training, even though they may be college graduates. A number of companies select promising young people who have gained experience in other departments and train them for underwriting and claims work. People selected from within the company usually have acquired some knowledge of policy provisions or insurance procedures required in their new jobs.

In addition to the employees in their home offices, insurance companies have large numbers of agents assigned to agency offices. Agents and brokers make up nearly 40 percent of all insurance employees and are exceeded in number only by the clerical workers. Employment opportunities for clerical workers, as well as for the two main types of agents—those selling life insurance and those selling property and casualty insurance —are discussed in statements on pages 591 and 594. Employment opportunities for actuaries—the small group of professional workers responsible, in large part, for the soundness of the insurance business—are discussed in a separate statement on p. 596.

Where Employed

Insurance companies and agencies do business in every section of the country. However, insurance workers are concentrated in the States with the most population and industry. New York leads all other States, with approximately 15 percent of the country's insurance employment in 1950, followed by California with nearly 9 percent. The other States which are in the first 10 in insurance employment are also those with the largest population, with one exception. Connecticut, a long-established center for insurance home offices, has as many insurance workers as Michigan, though the latter State has three times the population.

Insurance workers are employed mainly in large metropolitan areas where most home offices are located. For example, in 1950, more than 80 percent of California's insurance workers were in the San Francisco–Oakland and Los Angeles metropolitan areas. The location of company home offices also affects the type of employment available, since such offices employ many more clerical workers, administrative officers, and professional workers than do insurance agencies.

For many years, most large life insurance companies (those with more than $1 billion of insurance in force) were located in the Northeastern States. However, in the past 15 years, the number of large companies has tripled and become more widespread geographically.

A few companies doing a nationwide business each employ more than 10,000 workers in their home offices and are served by an even greater number of agents located throughout the country. Some small companies have no agency outlets and cover only a limited area with their few employees. The vast majority of agency offices have fewer than 10 employees; only a small proportion have 100 or more.

Employment Outlook

Many thousands of job openings in insurance companies and agencies are expected each year during the 1960's. Employment, which increased by more than 50 percent from 1948 to 1958, will probably rise at a more moderate rate over the next 10 years. Most openings will be for clerical workers and insurance agents. In addition to the new jobs, many openings will result from turnover, which is high for insurance agents during their first few years of employment, as well as for the large number of young women clerical workers. Although most job openings will naturally be in these largest occupational groups, qualified young people will also be in demand as trainees for positions in underwriting, claim adjusting, programming for electronic computers (see p. 208), investment analysis, and actuarial work.

Among the basic factors which point to expansion of the life insurance business are the rapid growth of population and favorable economic conditions which make it possible for more people to buy insurance policies. Advances in medical science make insurance available to people formerly turned down as poor risks. Continued growth is expected in group pension, health, and welfare plans for employees. The need to finance longer periods of retirement also may lead more people to buy retirement annuities. Catastrophe medical plans, to take care of expenses during major illnesses, which covered approximately 13 million people at the end of 1957, will probably continue to increase. Policies for educational purposes may become more widespread as more parents plan to send their children to college and as the period of expensive educational preparation required for professional work is lengthened further in many fields.

Growth of the property and casualty insurance field is also expected with the continuation of favorable economic conditions. Insurance needs of businessmen will probably continue to rise as additional plants are built and new and more expensive machinery is installed. Automobile insurance, the largest branch of the casualty field, will continue to grow with increasing car ownership and the extension of laws requiring insurance. More purchases of new homes by families will also expand property and casualty insurance sales. Additional sales may result from coverage relating to unusual hazards—for example, policies which insure persons and property against radiation hazards from atomic reactors. More policies will be sold as coverage under workmen's compensation laws is continued and broadened under State legislation.

Although the outlook is favorable for expanded insurance employment, it is probable that the rate of increase will be lower than that anticipated in insurance sales. A major factor that must be considered is the increasing use of new office machines, especially electronic computers. This factor—commonly referred to as automation—will affect employment in some occupations more than others. The effect of the extensive use of electronic equipment is discussed further in the statement on insurance clerks and office machine operators later in this chapter.

Insurance workers have more assurance of regular employment than workers in many other industries. People attempt to retain as much basic financial protection as possible, even when incomes decline. For most businessmen, property insurance of all kinds is a necessity in years of economic recession as well as in boom periods.

Where To Go for More Information

General information on employment opportunities and requirements may be obtained from the personnel department of major insurance companies or from insurance agencies in local areas.

Information on careers in life insurance is available from:

Institute of Life Insurance,
488 Madison Ave., New York 22, N.Y.

Life Office Management Association,
110 East 42d St., New York 17, N.Y.

Information on careers in the property and casualty insurance field is available from:

Association of Casualty and Surety Companies,
60 John St., New York 38, N.Y.

National Board of Fire Underwriters,
85 John St., New York 38, N.Y.

For additional information on salaries of clerical workers in finance industries including insurance, see:

Wages and Related Benefits, 19 Labor Markets, 1957-58, Bureau of Labor Statistics Bulletin 1224-20, 1959. Superintendent of Documents, Washington 25, D.C. Price 50 cents.

The following publication gives information on training requirements, earnings and working conditions of personnel in occupations connected with the electronic data-processing systems used in insurance and other industries:

Automation and Employment Opportunities for Officeworkers, Bureau of Labor Statistics Bulletin 1241, 1958. Superintendent of Documents, Washington 25, D.C. Price 15 cents.

Insurance Clerks and Office Machine Operators

Nature of Work

More than 400,000 clerical workers were estimated to be employed in 1958 in the insurance business to handle the mountains of paperwork necessary to keep millions of insurance policies in order. About 40 percent of them are secretaries, stenographers, and typists. (See statement on p. 234.) The others have a variety of titles depending upon their assignments. Like office workers in other industries, they may answer telephones, file, route, sort, and perform other duties connected with records and correspondence. Many use adding, calculating, and other machines to figure rates, prepare tables, or list and total data for reports. Some operate keypunch or tabulating machines and, nowadays, a small but growing number work with electronic computers to handle recordkeeping on tremendous masses of data. About 85 percent of all clerical workers in insurance companies are women—a higher proportion than in most other businesses.

Clerks in home offices, where most clerical work is centralized and specialization is feasible, are generally assigned a few specific duties. In contrast, those in insurance agencies usually perform a variety of clerical operations. A clerk in an agency office may, for example, type agents' reports, use an adding machine, file correspondence, operate the switchboard, and mail policy applications to the home office. Clerks in agencies are usually supervised by the *cashier* who also handles premium payments on policies and mails them at regular intervals to the home office. The cashier in a home office is likely to be responsible only for bookkeeping records and money transactions.

Many home office clerks are concerned with individual insurance policies—copying information on policy forms, checking, and correcting information. Some known as *policy writers* (D.O.T. 1-37.32) type information, such as name, address, amount of policy, and premium rate, from approved application forms to policies. *Policy change clerks* (D.O.T. 1-08.12) revise policies following instructions from agents as to changes in the beneficiary or in the policy amount. To make sure that work is accurate, several kinds of *insurance checkers* (D.O.T. 1-03.02) are employed, whose titles reflect the type of insurance action that is taken, for example, *policy change checkers* examine policies drawn up after changes have been made and see that all information has been correctly entered on company records. *Underwriter clerks* (D.O.T. 1-05.01) are usually in training for more responsible work; they assist underwriters by performing various clerical duties such as filing and checking applications for errors.

Large numbers of office machine operators are employed in home offices and, to a lesser extent, in agency offices. In addition to machines commonly used in many business offices—adding, billing, bookkeeping, Addressograph, and Mimeo-

Insurance companies employ large numbers of office machine operators.

graph machines—many insurance companies also use keypunch and tabulating machines. The *keypunch operator* presses keys on a machine similar in action to a typewriter, except that the keypunch machine makes holes in cards instead of printed letters. The operator follows a special code of instructions to punch holes which represent information about an insurance policy. The punch cards are used by *tabulating machine operators* who adjust and operate machines that sort and count various items on the punch cards, multiply or make other calculations, and print the final results. Punch cards may also be used in electronic data-processing machines.

Large insurance companies are among the leading employers of clerical workers who perform work in connection with the operation of electronic computers and related machines. *Console operators* operate the central control unit (console) of the electronic computer, using instruction sheets prepared by programmers (see p. 208) to determine the setup of the equipment and operating procedures. Operators of other machines that make up electronic data-processing systems may include: *Card-tape converter operators* who run the machines that convert data from punch cards to tape or vice versa; *high-speed printer operators* who operate machines that print final results on records or reports; and *data typists* who use electric typewriters equipped with special keyboards to transcribe instructions or data on magnetic tape. (For additional information, see statement on office machine operators on p. 230.)

Where Employed

Clerks and office machine operators are employed mainly in home offices of insurance companies which, as indicated earlier, are concentrated in large cities. Nevertheless, there are some opportunities for employment in agencies in all cities and in many towns of each State. (For additional information see Where Employed on p. 586 of this report.)

Training, Other Qualifications, and Advancement

Graduation from high school or business school is adequate preparation for most beginning clerical jobs in insurance companies. Courses in typing, business arithmetic, bookkeeping, and shorthand are generally considered desirable. Training in the operation of office machines is also valuable, in view of the widespread use of adding, calculating, bookkeeping, and other machines in insurance companies.

Applicants for jobs in insurance companies are usually given an interview and may be given intelligence and clerical aptitude tests. Young people who have worked part time or held summer jobs with an insurance company have an excellent chance of being hired for regular work.

Inexperienced young men and women may start out in a variety of clerical jobs, such as insurance checker, file clerk, and bookkeeping clerk. In some large insurance companies, employees not already trained in office machine operation can qualify for such work through classes conducted by the company. Employees can also improve their chances for advancement by enrolling in the industry-sponsored educational program of the Life Office Management Association Institute. The courses cover principles of life insurance agency organization, elements of office management, and other phases of the insurance business.

Promotion from a routine clerical job may be first to a minor supervisory position and then to section head. Some companies select promising young clerical workers to train for underwriter or claim adjuster positions. Bookkeeping experience is usually required for advancement to positions as cashier either in a home or agency insurance office. Insurance companies usually follow a "promotion-from-within" policy, taking length of service, on-the-job performance, and leadership qualities into consideration. This policy is also being applied by some companies in selecting workers to fill new and better paying positions in connection with the use of electronic computers. There are some opportunities for outstanding clerical workers to advance to positions as officers, though many insurance companies prefer to hire people with college backgrounds for training as executives.

Employment Outlook

Employment opportunities for clerical workers are expected to be good during the early 1960's, as the insurance business continues its remarkable growth. A number of new jobs will become available as plans for opening additional insurance agencies are carried out and long-established agencies and home offices expand. However, turnover—which is high among the many young women employees—will continue to be the major source of job openings.

Over the long run, employment of clerical workers will grow more slowly than in the recent past, because of the greater use of electronic computers. These machines will displace many clerks, most of whom are now employed in routine jobs such as sorting or filing records, or operating calculating and bookkeeping machines. On the other hand, the introduction of the newer electronic machines will create a number of new and generally more skilled and better paying jobs. In all probability, few, if any, clerks will become unemployed as a result of the installation of new machines. Some insurance companies faced with the necessity of reducing clerical staffs have met the problem by not filling vacancies arising from normal turnover and by transferring employees elsewhere in the company where help was needed. It is expected that other insurance companies will similarly absorb their displaced clerks. The growth of multiple-line selling in the property and casualty insurance fields—that is, the sale of a single policy rather than several policies to cover a variety of insurance risks—will also tend to reduce the clerical workload in the future.

Earnings and Working Conditions

Women in beginning clerical jobs, such as office girl and file clerk, in banks, insurance companies and related businesses had average weekly earnings ranging from $43 to $55 in 13 large cities surveyed in 1957–58 by the Bureau of Labor Statistics. Beginning typists had average salaries ranging from $46 to $59 a week in the cities surveyed; more experienced typists from $54 to $68. Secretaries were usually the highest paid women clerical workers in the nonsupervisory jobs surveyed, averaging $70 to $84 a week. Men accounting clerks were the highest paid of all the groups surveyed, with average weekly salaries between $80 and $90 in most of the 13 cities. For most groups of clerical workers, pay levels were found to be highest in Chicago, Cleveland, New York City, and the San Francisco-Oakland and Los Angeles-Long Beach areas.

Most employees in the insurance, finance, and related industries worked less than 40 hours a week in large cities in 1957–58. Compared with many other industries, the number of holidays given insurance workers is usually quite liberal; 11 paid holidays are particularly common in the Northeastern States. Two-week vacations after 1 year of service are given by most insurance companies. A number of companies allow 3-week vacations after 10 or 15 years and 4 weeks after 20 or 25 years of service. Life insurance, retirement plans, and hospitalization and surgical benefits are usually granted insurance employees.

Work in insurance companies is generally carried on in clean, well-lighted, and often air-conditioned offices. Many companies have dining rooms for employees, recreation rooms, and lounges. Since many clerical jobs are of a routine and sedentary nature, they are suitable for workers with certain types of physical handicaps.

(See introductory section of this chapter for Where To Go for More Information.)

Life Insurance Agents

(D.O.T. 1-57.10)

Nature of Work

Life insurance agents sell policies that provide life insurance and retirement protection for individuals and groups. Many of them also sell accident and health policies. Agents are sometimes referred to as life insurance salesmen and may also be called life underwriters, since they frequently play a major part in judging insurance risks on small policies.

A life insurance agent spends most of his time meeting people in their homes or places of business to explain different types of insurance. Part of the agent's time is spent in his agency office selecting new prospects to whom he should try to sell insurance and planning insurance programs for his clients. He may also arrange for necessary physical examinations, help clients fill out application forms, assist with benefit claims, and perform other services. An agent who sells small policies, usually those amounting to $500 or less (called industrial life insurance), is responsible for collecting premiums from policyholders.

Approximately 196,000 life insurance agents (about 3 percent were women) were employed full time in 1956 in selling policies on an individual or group basis. Many were combination agents hired by companies to sell both ordinary life policies (usually in amounts of $1,000 or more) and industrial insurance. Most life insurance agents represent only one company and work in a branch or district office maintained by that company. This working arrangement contrasts with that of casualty and fire insurance agents who usually represent several companies.

Unlike most salesmen, who sell goods or property which a buyer can see, the life insurance agent is concerned with selling an idea—one of financial protection. He should be able to explain clearly in nontechnical language the various kinds of policies available, the costs involved, and the benefits provided. Companies frequently evaluate their agents on how long the policies they sell remain in force. Therefore, an agent must try to balance a client's ability to pay against his need for protection and help him make a wise decision. This usually results not only in a more desirable sales record but may bring referrals for new prospects from satisfied policyholders. During the one or more visits required to sell a policy, the agent must establish a personal relationship which inspires confidence in his ability and integrity.

Agents have a great deal of independence and personal responsibility for planning their work. They must build up lists of prospective customers from referrals made by personal acquaintances or satisfied clients, or from other sources. Additional business often depends on the individual agent's ability to gather as much pertinent information as possible on policyholders—for example, births in a family, purchase of a new home, improvements in income status, or other factors that indicate a prospective sale of additional insurance.

Where Employed

Life insurance agents are employed in agencies located throughout the country. Although the greatest numbers of agents are in States with the most population and in large metropolitan areas, opportunities are increasing in smaller, newly developed areas which have rapidly growing indus-

Life insurance agent calls at client's home to discuss new policy.

tries and above average increases in population. Agents who sell industrial life insurance are usually assigned exclusive rights to sell weekly premium business for their company in a specified location—called a "debit area"—which is sometimes a small town or a part of a city. (For additional information see Where Employed on p. 586 of this report.)

Training, Other Qualifications, and Advancement

Most life insurance companies seek mature people, at least 21 years of age, to train as life insurance agents. The applicants must have the aptitude and personal qualities necessary for selling insurance and the ability to grasp insurance fundamentals. Although no formal educational requirements exist, the majority of agents hired in recent years have had some college training and many are college graduates. Many companies prefer persons with some business experience, especially in work where contacts with people are important. Since effective selling often depends on a sound personal relationship between agent and client, the insurance agent who is poised, a patient listener, and able to answer his client's questions simply and clearly has a good chance of success.

Young people interested in beginning as life insurance agents may apply to agencies in their own communities, where their acquaintances are centered, or they may write to the main offices of insurance companies. In hiring agents, a number of companies, in addition to personal interviews, give tests to determine an applicant's aptitude for selling life insurance. A well-rounded program of on-the-job training and education is conducted by most companies for beginning agents. In addition, agency managers assist agents with their individual problems and may assign experienced agents to do joint selling with newcomers.

An agent must be licensed in each State where he sells insurance. To obtain a license, the agent must be sponsored by the company he represents, which usually pays for the license. Many States issue a preliminary license, and later a permanent one after the agent has gained sufficient knowledge of the insurance business to pass a written examination. In mid-1958, 37 States required an agent to pass a written examination. Such examinations generally include questions on the insurance laws of the State and life insurance fundamentals. Other States issue licenses without examination, but usually require the sponsoring company to submit statements on matters such as an agent's residence and character.

Agents can continue to broaden their knowledge of the life insurance field by participating in industry-sponsored educational programs. After 1 year of selling experience, life insurance agents can enroll in courses offered by the Life Underwriter Training Council (LUTC). These courses emphasize selling techniques and are designed to improve the students' sales and service ability. More advanced study at the college level is available under the program of another industry-established organization, The American College of Life Underwriters. Agents choose their own method of study—at home, through cooperating colleges and universities, or in company-organized study groups. Candidates who pass required examinations and have 3 years of insurance experience are awarded the designation, Chartered Life Underwriter (CLU) and are eligible to join the American Society of Chartered Life Underwriters. The examinations test an agent's ability to apply his knowledge of life insurance and related business subjects—economics, business law, taxation, trusts and finance—to insurance problems. The CLU designation is recognized as a mark of attainment in the insurance field. In addition to the programs mentioned, other sources through which agents may increase their knowledge include colleges which offer advanced courses in some phases of insurance, special life insurance marketing institutes (located at Purdue and Southern Methodist Universities), and institutes, conferences, and seminars sponsored by various insurance organizations.

Promotion to assistant manager or manager of an agency office usually depends upon demonstrated sales ability and leadership qualities necessary to build and supervise a selling force. Some companies use aptitude tests as a guide in promotions. A few agency managers may advance eventually to regional supervisor of a group of agencies, superintendent of agencies, assistant vice president, or vice president in charge of agencies.

Employment Outlook

Employment opportunities for life insurance agents are expected to be good during the early 1960's. Based on companies' plans for expansion, it is estimated that about 5,000 new full-time agent positions will have to be filled annually for several years. In addition, many thousands of agents will be needed each year to replace those who retire, die, or change to other types of work. However, some decrease in the turnover rate among beginning agents is expected as a result of continuing improvements in selection, training, and company salary plans for newcomers. Employment opportunities for agents and agency managers are expected to be particularly numerous in suburban areas of large cities and in cities with less than 100,000 population.

Though the number of life insurance agents will continue to rise over the long run, employment will not increase as rapidly as might be indicated by the anticipated tremendous growth in insurance sales, since individual policies of larger amounts will be sold. Group insurance sales are also expected to become more widespread and to some extent such sales may reduce the need for agents.

The trend toward giving preference to college graduates in selecting insurance agents is likely to continue, and companies are expected to place greater emphasis on in-service training of beginning agents. Nevertheless, industry preference for agents with previous business experience will continue to be a factor favoring the employment of mature workers, and many companies will probably continue to allow older experienced agents to engage in some selling activity after they retire.

Earnings and Working Conditions

Beginning agents, faced with stiff competition from experienced salesmen, are usually financed under company plans for periods up to 3 years. In most companies, these financial arrangements remain in effect only if the agents sell a specified minimum of insurance. After the first few years, agents' earnings take the form of commissions representing a percentage of the premiums paid by clients to whom they have sold policies. Usually, a large initial commission is paid on newly sold policies. Then on all policies which are kept in force, agents receive a small renewal commission each year for several years and, subsequently, they may receive a still smaller annual service fee. As renewal commissions build up over a period of years, an agent's total income increases even if he sells only about the same amount of insurance each year. After 4 or 5 years, a life insurance agent may earn \$5,000 to \$10,000 a year. Earnings are considerably higher for the most successful agents. Many companies have various kinds of benefit programs for agents employed in branch or district offices—such as life insurance and pensions, and hospital, surgical, and medical benefits.

Agents make several calls a day and frequently use a car in their work. They usually pay their own automobile expenses, although a few companies now pay part of this cost. Sometimes, it is necessary for agents to make evening or weekend appointments for the convenience of clients.

Where To Go for More Information

General information on employment of agents may be obtained from personnel directors of life insurance companies and local organizations of life insurance agents. Information on State licensing requirements may be obtained from the department of insurance at any State capital. Information on life insurance agents is also available from:

Institute of Life Insurance,
488 Madison Ave., New York 22, N.Y.

Life Insurance Agency Management Association,
855 Asylum Ave., Hartford, Conn.

506397 O—59——39

Property and Casualty Insurance Agents and Brokers

(D.O.T. 1-57.10)

Nature of Work

People who sell insurance against property loss or damage are called property and casualty insurance agents. Unlike life insurance agents, most property and casualty insurance agents are independent businessmen who represent several insurance companies. Both types of agents must understand insurance fundamentals, and must be able to establish sound personal relationships with clients. They spend most of their time meeting people to explain policy terms and evaluate insurance needs. In addition, property and casualty insurance agents are often required to be familiar with production processes, the kinds of losses that can occur in industry, and the safety measures used in plants, so that they can explain clearly and simply how much and what kind of insurance may be needed. If they sell workmen's compensation, automobile liability, and other kinds of public liability insurance they must have a knowledge of the various hazards that may cause injury to people for whom the insured is responsible. Agents representing multiple-line companies may sell a single policy which protects the owner of a dwelling or industrial plant against fire, explosion, burglary, and other hazards. The many agents who have contracts as representatives of more than one insurance company must select the particular company that best satisfies the client's needs. Some agents specialize in selling one kind of insurance—for example, accident and health or automobile insurance.

An agent usually spends part of the day in the agency office planning his daily schedule of visits and compiling a list of prospects. He also keeps up-to-date records of his clients' needs, as a basis for additional sales, and works out insurance programs adapted to a client's circumstances. The agent who carefully attends to servicing his clients' needs, whether he helps them file a benefit claim or suggests the need for additional protection, will establish a successful record of insurance renewals.

Brokers handling property and casualty insurance do not have contracts with any particular company but are independent middlemen who place policies through agents or directly with insurance companies. Clients rely upon the broker's judgment and wide knowledge to select the best financial protection and place their policies with the most suitable companies.

Where Employed

The more than 100,000 property and casualty insurance agents and brokers do business in every section of the country. Widespread ownership of automobiles and homes and continuation of the trend toward suburban living has created favorable opportunities for agents outside of large cities. Brokers may be located in small as well as large cities, but the largest volume of insurance is handled by brokerage firms in population centers such as New York, Chicago, Philadelphia, and Los Angeles. (For additional information, see Where Employed on p. 586 of this report.)

Training and Other Qualifications

An agent or broker must obtain a license in each State where he sells insurance. Two-thirds of the States require an agent to pass a written examination which usually covers the insurance laws of the State and property and casualty insurance fundamentals. In some States, in order to be eligible to take the licensing examination, an applicant must meet certain educational requirements in the field of insurance. States not requiring examinations, generally issue licenses upon receipt of statements on such matters as the agent's residence and character.

Newcomers, who usually start by selling the simpler types of policies, may increase their knowledge of the insurance business by experience and by study under company or industry-sponsored programs. Most companies or agencies have some method—ranging from carefully planned training programs to on-the-job supervision—to help new agents get started. Many large companies and agencies prefer to hire college graduates or men with some college training, who can easily grasp insurance fundamentals. It is of special importance to agents or brokers operating their own businesses to have an expert knowledge of various types of insurance and some background in subjects such as accounting, economics, and business law. Agents who deal with industrial firms benefit from acquiring a knowledge of manufacturing processes, safety methods, and construction problems.

The Insurance Institute of America has an educational program for agents who wish to learn the fundamentals of property and casualty insurance. Certificates are issued to those who pass Institute examinations. The National Association of Insurance Agents offers elementary and advanced educational programs for agents. Opportunity for advanced study is available through the program of the American Institute for Property and Liability Underwriters, Inc. Agents can study at home or in classes conducted by colleges, insurance societies, and company groups. Upon the successful completion of 5 written examinations and fulfillment of a 3-year insurance experience requirement, agents receive the designation of Chartered Property Casualty Underwriter (CPCU) and become eligible for membership in the Society of Chartered Property and Casualty Underwriters.

The knowledge gained in acquiring the CPCU designation, a recognized mark of attainment in the insurance field, is valuable to persons interested in becoming brokers or operating an agency —either their own business or one in which they have purchased a partnership share. It may also help one qualify for home office supervisory and executive positions.

Ease in dealing with people is one of the personal characteristics helpful to agents in their contacts with clients. They also need a good sales approach and the ability to explain insurance matters simply and clearly. In addition, since agents are largely responsible for directing and planning their own work, they must be willing to take the initiative in obtaining prospects for sales and in giving service to policyholders.

Employment Outlook

Numerous opportunities for agents to enter the property and casualty insurance business will arise in the early 1960's, assuming that general economic conditions remain favorable. Many new agents will be required to meet the growing business and individual needs for insurance protection, as discussed in the introductory section of this report. Replacements will also be needed for agents who retire, die, or otherwise withdraw from the occupation.

Jobs for agents will increase with general economic growth, since most businessmen and consumers budget insurance as a necessary expense. In 1958, American business firms invested approximately $30 billion in new plants and equipment. Every expansion in business plant or equipment, every home, automobile, or other expensive item purchased by consumers represents a potential sale of insurance for agents. Continued extension of public liability laws, such as workmen's compensation and automobile liability laws, will also create a larger insurance market. Not only will there be a need for additional agents to sell an increasing number of policies, but the greater value of insurance sold by individual agents may result in higher earnings for agents. Although employment prospects are favorable for agents, competition for sales—always keen in the insurance field—will continue to be strong.

In the long run, a growing number of companies and agencies are expected to select college graduates or persons with some college background to train as agents. Greater emphasis will also be placed on in-service training of agents in order to prepare them to handle many different types of insurance. Recent legislation permits companies to include insurance of various kinds in one policy. Beginning agents representing multiple-line companies will therefore be required to have a broad knowledge of the property and casualty insurance field.

Earnings and Working Conditions

Earnings of property and casualty insurance agents are largely related to an individual's ability to find prospective clients and to make sales. Although some new agents receive moderate salaries, most of them must depend mainly on commissions from sales. After a few years, when earnings generally are from commissions alone, annual income may be $5,000 to $10,000. A small proportion of highly successful agents earn substantially more.

Commission earnings are based upon a percentage of the annual premiums paid by policyholders. The same commission rate paid for new sales applies to renewals, which commonly occur after 3 to 5 years on many property and casualty policies. Renewal of automobile insurance is generally on a yearly basis. Agents whose work is interrupted by causes such as illness continue to receive commissions if policyholders renew their policies.

The agent or broker who owns his agency must pay his own expenses, like any other independent businessman. Major items frequently are rental payments and clerical salaries, which vary with the size of the agency. Agents generally pay their own automobile or other travel expenses.

Where To Go for More Information

Information on employment of agents may be obtained from most property and casualty insurance companies and agencies. Licensing information may be obtained from the department of insurance at any State capital.

Further information on the property and casualty insurance field is available from:

National Association of Insurance Agents, Inc.,
96 Fulton St., New York 38, N.Y.

The National Association of Mutual Insurance Agents,
829 Investment Building, 1511 K St. NW., Washington 5, D.C.

Information concerning education in the property and casualty insurance field is available from:

The Insurance Institute of America, Inc.,
3924 Walnut St., Philadelphia 4, Pa.

The American Institute for Property and Liability Underwriters, Inc.,
3924 Walnut St., Philadelphia 4, Pa.

Actuaries

(D.O.T. 0–36.55)

Nature of Work

Actuaries are mathematicians whose main job is to keep insurance plans financially sound. To do this, the actuary must gather and analyze masses of statistical data and be able to explain their meaning clearly and simply. A number of actuaries hold important executive positions and give advice and assistance in practically all kinds of insurance work.

Actuaries must evaluate the risks on what is being insured, in order to set the premium rates for different kinds of insurance. They are concerned with losses from death, sickness, and injury and with personal and property losses from fire, burglary, explosions, and other hazards. In their work, actuaries consider the frequency of such losses and their costs. On the basis of continual research, they may prepare records on mortality (death) and morbidity (sickness), and compute tables of premium rates and policy values. They are responsible for the analysis of company earnings and often develop general insurance plans and help in preparing the contract provisions. Actuaries must continually study new developments and make revisions whenever necessary. This calls for an understanding of general business trends as well as legislative, social, and other factors that may affect the insurance business.

Because of his broad knowledge of the insurance field, an actuary frequently works on problems in other departments, such as investment, underwriting, and group insurance and pension sales and service. In an important executive position, he may help decide general company policy and testify before public agencies on proposed legislation or on justification of company rates. He may also prepare articles, press releases, and speeches.

Actuaries employed by the Federal Government usually deal with a particular program such as social security, or insurance for veterans and members of the Armed Forces. In State governments, actuaries are involved in the supervision and regulation of insurance companies and may work on problems connected with unemployment insurance or workmen's compensation. Consulting

Actuary working with tables showing sickness and death rates in connection with preparing insurance plans.

actuaries may be hired on a part-time basis to perform any actuarial services that may be required by private companies or governmental agencies.

Where Employed

Approximately 2,000 professional actuaries were employed in 1958. More than 1,600 worked in the life insurance field and the remainder in property and casualty insurance. About 10 percent of all actuaries work for consulting firms or are in business for themselves. The Federal Government employs about 50 actuaries, chiefly in the Department of Health, Education, and Welfare and the Veterans Administration. Most of the remaining actuaries are employed by State government agencies; a few are with property and casualty insurance rating bureaus.

The size of companies' actuarial staffs depends upon the volume and nature of their insurance work. A few of the largest companies which sell all lines of insurance or have a tremendous group insurance business, each employ as many as 50 to 100 actuaries. Small companies, however, may have only 1 or 2 actuaries on their staffs or may rely entirely on consulting firms for actuarial services. In the property and casualty insurance fields, actuarial services are often shared by a number of companies, through associations specializing, for example, in factory, marine, or aviation insurance.

Training, Other Qualifications, and Advancement

College graduation with a major in mathematics is the generally accepted educational requirement for entry into actuarial work. In addition to courses in higher mathematics—including differential and integral calculus, analytical geometry, the principles of mathematical statistics, probability, and finite differences—courses such as actuarial mathematics and insurance law may be helpful. Various business studies in fields such as economics, investments, and accounting, and courses in English composition and speech may also prove valuable. A well-rounded educational background and the ability to deal with people and to express oneself clearly and simply are important qualifications.

Most actuaries gain professional status after passing examinations in life insurance given by The Society of Actuaries or those in property and casualty insurance given by the Casualty Actuarial Society. An actuary becomes an "Associate" in the Society of Actuaries after completing that Society's first 5 examinations, and in the Casualty Actuarial Society after passing its first 4 examinations. The designation of "Fellow" is conferred after completion of all 8 examinations given by either society. It usually takes more than 5 years to complete the entire series. For the more advanced examinations, experience in insurance work and intensive home study are usually required. It is desirable for students to take some of the early examinations while still in college. Success in these examinations helps the student determine whether he has the ability to become an actuary and greatly increases his opportunities for employment.

In interviewing applicants for actuarial work, company officials evaluate both their mathematical ability and characteristics such as leadership, the ability to deal with people, and an interest in business problems. Preference in hiring is usually given to persons who have passed at least two of the actuarial examinations mentioned above, and to those with part-time actuarial experience. This experience is provided in many insurance companies which hire and train college undergraduates during the summer months.

A beginning actuary is usually rotated among different jobs in the actuarial department, so that he can learn the various actuarial processes and become acquainted with different phases of insurance work. At first, the actuarial trainee may make calculations or tabulations for actuarial tables or for the annual statement. Later he may supervise actuarial clerks and be concerned with correspondence and reports.

Advancement to more responsible work as an assistant and later as associate or chief actuary depends largely upon on-the-job performance and passing the actuarial examinations. A number of actuaries, because of their broad knowledge, eventually qualify for high administrative positions in other areas of company activity, particularly in the underwriting, accounting, or investment departments. A few advance to top executive positions as company vice presidents or presidents.

Employment Outlook

Actuaries are expected to find very favorable opportunities for employment during the early 1960's. Although the field is small, it is far from crowded. In 1958, a number of insurance companies had unfilled positions for actuaries. Moreover, the U.S. Civil Service Commission authorized above-minimum starting pay rates for actuaries in the Federal Government to help meet a critical need for personnel in this occupation. The insurance industry will continue to compete for the limited supply of persons with a strong mathematical background, who are also greatly in demand for jobs in many other industries. (See statement on Mathematicians, p. 130.)

Over the long run, actuarial work is expected to increase with the growth of the insurance industry (discussed in the introductory section). Replacement needs, resulting from deaths, retirements, and resignations, will also provide some openings. More jobs will arise as actuaries in the field need more assistance to handle problems arising from changing and more complex insurance coverages. The fast-growing group life insurance plans, as well as pension plans, will require additional actuarial service. The greater use of electronic data-processing machines by insurance companies will also increase the demand for actuaries who will be needed to help work out complex problems connected with the use of this equipment.

Some expansion in employment of actuaries in property and casualty insurance is also expected, though actuaries in this field will probably remain a much smaller group than in life insurance. Additional actuaries in the property and casualty insurance field will be needed to make the studies which are used as the basis for rate changes in the short-term policies typical of this field and to present justification for these changes before State regulatory agencies. New "multiple line" selling may eventually lead to larger companies in the property and casualty field and these companies will also require the services of more full-time actuaries.

Employment opportunities will probably continue to be good for the few women who qualify as actuaries. However, young women who withdraw temporarily from the labor market because of family responsibilities or for other reasons may find it difficult to complete the years of continuous training and study required to gain full professional status.

Earnings and Working Conditions

Actuarial trainees are generally offered higher starting salaries than most college graduates hired for positions in the home offices of insurance companies. Many companies paid annual salaries between $4,500 and $5,000 to actuarial trainees in 1958. Persons who have passed some preliminary examinations given by the professional actuarial societies usually receive higher starting salaries. A Fellow of either Society, or a person with comparable knowledge, experience, and ability in actuarial work, may receive $10,000 a year or more. Earnings increase thereafter with experience and added work responsibility. Annual salaries of $25,000 and more may be earned by actuaries in executive positions in large companies. The Federal Government paid most beginning actuaries $4,490 a year as of late 1958; some actuaries with higher qualifications were being recruited for Federal jobs at annual starting salaries of $7,510 or $8,810, depending on an applicant's education and experience.

Actuaries generally work in modern, well-equipped offices, which are adequately lighted and ventilated. They usually work a regular 5-day week averaging between 35 and 40 hours. Insurance companies provide a liberal number of paid holidays and give vacations which are increased with length of service. Actuaries also share in the group insurance and pension plans, as well as in other employee benefit programs offered by many insurance companies.

Where To Go for More Information

Information, particularly on actuarial examinations, may be obtained from the following professional societies:

Society of Actuaries,
208 South LaSalle St., Chicago 4, Ill.

Casualty Actuarial Society,
200 East 42nd St., New York 17, N.Y.

Additional information is given in:

Educational Requirements for Employment of Actuaries, V.A. Pamphlet 7–8.1, Bureau of Labor Statistics in cooperation with Veterans Administration, 1955. Price 15 cents.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

Our country's industrial power, the basis for its high standard of living and great military strength, rests largely on our great steel production capacity. In 1958, the United States produced about 30 percent of the world's output of this vital metal. This country's per capita production of steel was several times the average for the world as a whole.

One of the Nation's largest employers, the industry had about 560,000 wage and salary workers on the payrolls of its more than 300 plants in late 1958. The industry employs workers, ranging from highly specialized professional and technical workers to unskilled laborers, in a great variety of jobs. Many of the jobs are found only in iron and steel making.

The iron and steel industry consists of plants engaged in a coordinated series of activities. In the first step, pig iron is made from ore in a blast furnace. (See chart 43.) Pig iron (together with scrap metal) is converted into steel in a second step. Finally the steel is rolled or drawn into basic products, such as plates, sheets, strips, rods, bars, rails, tin plate, and structural shapes. In many of the plants, manufacturing processes are carried beyond the rolling stage to produce fabricated products. (The mining of the raw materials is classified as a separate industry. Plants engaged in casting, stamping, forging, or machining steel purchased from steel-producing companies also are considered outside the basic iron and steel industry.)

Some iron and steel plant products, such as rails, pipe, wire, and nails, can be used directly without further manufacturing. However, the bulk of the products shipped from steel plants, such as sheets, bars, plates, and strips, are further fabricated in plants of other industries into hundreds of different products. The leading steel users are the automobile, construction and building material, machinery, railroad, and container industries.

Sheet metal is made into such things as automobile bodies and metal furniture. Bars are used in making various automobile and machinery parts, and in reinforcing concrete in building construction. Plates become parts of railroad cars, ships, bridges, and heavy machines. Strip steel is used in the manufacture of such products as pots and pans, automobile body parts, razor blades, and toys. Tin plate is used primarily to make tin cans.

Because the industry deals in large quantity bulk production, it uses huge processing equipment. Blast furnaces are sometimes more than 100 feet in height and 28 feet in diameter, with as many as a dozen in one plant. A single furnace may make up to 500 tons of pig iron each production cycle of about 5 or 6 hours. A typical open-hearth steelmaking furnace is as big as a building 70 feet long and 20 feet wide. These furnaces are loaded by enormous electrically operated "charging" machines and are emptied by giant crane operated ladles. Iron ore and scrap metal are brought into the plant by railroad cars and ships. The rolling equipment which presses the steel into various shapes extends hundreds of feet in length and its size dwarfs the men who handle this operation.

Plants in this industry are typically large. Although some specialized plants employ fewer than 100 workers, more than two-thirds of all the employees in this industry worked in plants with over 2,500 wage and salary workers each in late 1958. Steel companies differ in the number of operations they perform. Many companies (known as integrated companies) produce pig iron, make steel, and form steel products by rolling and finishing. These companies produce the great bulk of the steel and employ most of the workers in the industry. Another group of companies produces various types of steel from purchased pig iron and scrap. A third group rolls and finishes purchased steel; a fourth type produces only pig iron to be sold to rolling mills and foundries.

The geographic location of steel plants is determined by such factors as the location of their raw materials—coal, iron ore, etc.; the market for their products; and good transportation facilities.

The steel industry is concentrated mainly in the northern and eastern parts of the United States; the Pittsburgh-Youngstown area is the leading steel center. Farther east, there are large plants in Buffalo, N.Y.; Johnstown, Bethlehem, and Morrisville, Pa.; and Sparrows Point near Baltimore, Md. The Great Lakes region has many important steel centers, particularly in the Chicago area and Cleveland. Much of the steelmaking in the South is in the Birmingham, Ala., area. As a result of the World War II expansion program, steelmaking capacity has been increased greatly in the Far West—large mills were built in Geneva, Utah, and Fontana, Calif. About three-fourths of the industry's workers are employed in five States—Pennsylvania, Ohio, Indiana, Illinois, and New York. About a third of the industry's labor force works in Pennsylvania.

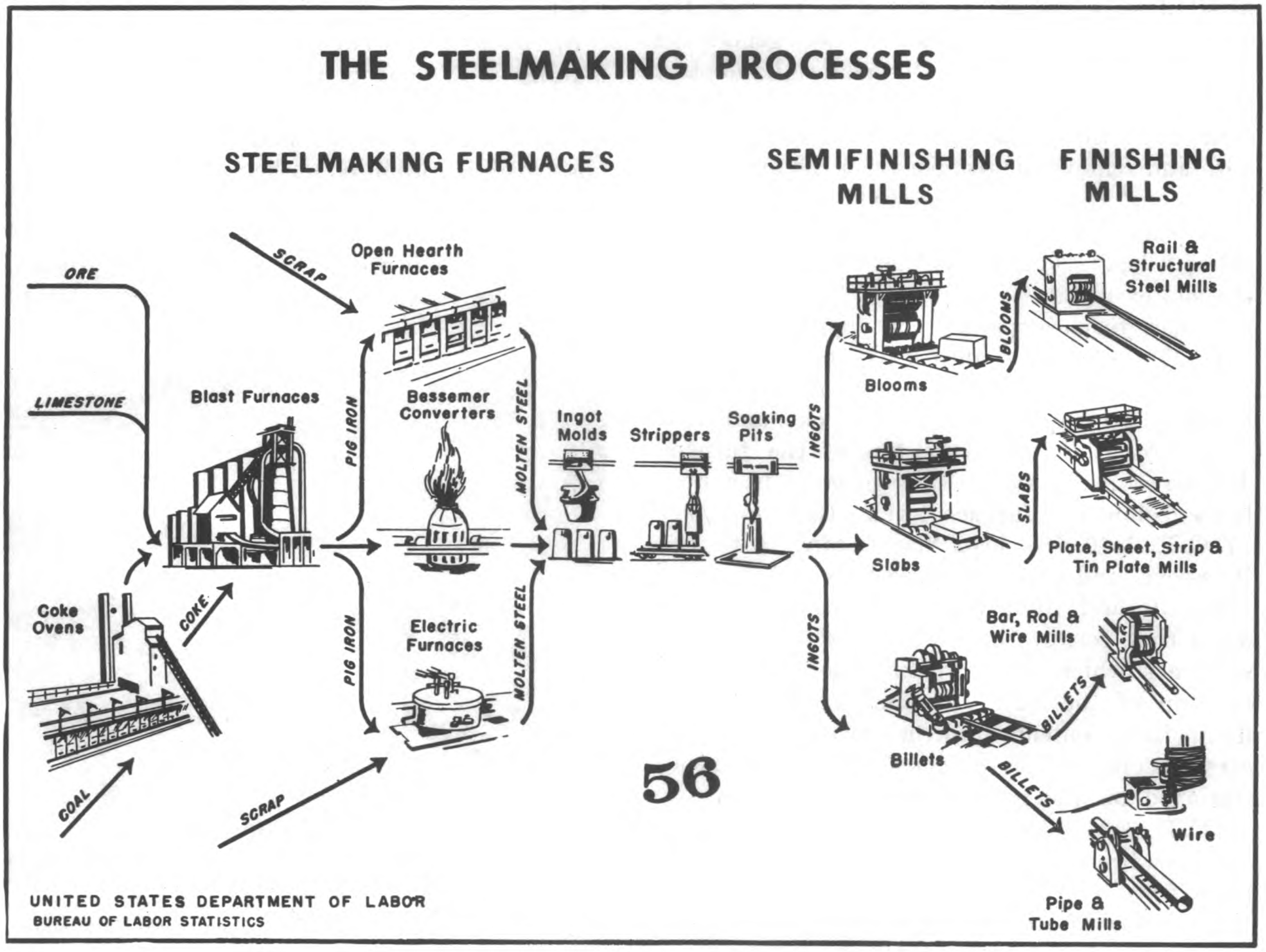
Occupations in the Industry

More than 1,000 different jobs are found in the plants and offices of the iron and steel industry. The following tabulation lists the number of wage and salary workers by major occupational group in late 1958:

Professional and technical workers	30,000
Administrative workers	10,000
Clerical and sales workers	75,000
Skilled workers and foremen	155,000
Semiskilled workers	200,000
Laborers, helpers, and miscellaneous service workers	90,000
Total employment	560,000

The work force of the industry is predominantly male, reflecting both the strenuous nature of some of the production work at present and the hard work under difficult working conditions that once characterized steelmaking generally. About 4 percent of the industry's labor force are women and approximately half of them work in office jobs. During World War II, a

CHART 43



large number of women entered the industry's plant labor force, and many have remained in such jobs as craneman, machine operator, sorter, and inspector. About one-eighth of the plant workers are Negroes. Although a large number work as laborers, many are employed in skilled and semiskilled occupations.

Processing Occupations. The bulk of the workers in the iron and steel industry are employed in the many processing operations involved in converting iron ore into finished and semifinished steel products, or shapes. In order to better understand the types of jobs in the steel industry a brief description of steelmaking and of important occupations, as they fit into the steelmaking production process, are given below.

Blast furnaces. The first step in making steel is to convert iron ore into "pig iron." In this process, alternate layers of coke, iron ore, and limestone are loaded into a blast furnace and a blast of very hot air is blown up through the mass. The air blast burns the coke, generating heat and gases which melt the material and start the necessary chemical reactions. The gases formed by the combustion of the coke combine with and remove the oxygen from the ore; at the same time, the melted limestone combines with nonmetallic matter in the ore to form a residue called "slag." The slag is then removed, leaving the molten metal.

A blast furnace operates continuously, 24 hours a day, 7 days a week, until it has to be shut down for repairs. Every 5 to 6 hours the molten iron is run off or "tapped." Iron ore, coke, and limestone are loaded into the top of the furnace. These raw materials are stored nearby in a stock house below the furnace level. Here *larrymen* (D.O.T. 7-40.050) load "larry cars" with ore, limestone, and coke from the bins, weighing all materials and following prearranged formulas. Then they convey the load through a tunnel to skip cars, which run up inclined double tracks to the top of the blast furnace. Here the skips dump their contents into the furnace. The skip cars are operated by *skipmen* (D.O.T. 5-73.550) stationed on the ground below. *Stove tenders* (D.O.T. 6-91.311) and their assistants operate the huge bricklined stoves which heat air for the blast furnace. They regulate valves which direct the flow of air into the furnaces and at regular intervals send cold air into stoves already heated and gas flame into those to be heated.

Blowers (D.O.T. 4-91.311) are responsible for the quantity and quality of iron produced. They supervise the whole blast-furnace operation, including loading and tapping the furnace, and regulating the air blast and furnace heat. Blowers carefully check the metal in the furnace, sampling the molten iron and slag and sending the samples to the laboratory where quality tests are made and the results reported back to the blower. *Keepers* (D.O.T. 4-91.321), under the direction of the blower, are responsible for the tapping of the furnace. They direct their helpers and *cinder snappers* (D.O.T. 8-92.01) in lining troughs and runners through which the molten iron and slag is run off. In plants in which both iron and steel are made, most of the molten iron is carried by giant ladles to the steel furnaces. If the iron is to be shipped or stored, it is cast into bars, or "pigs," and permitted to harden.

Steel furnaces. The second major step in steel making is to convert the iron into ingot steel. This is done in three ways. The principal process is the open-hearth method. In the other methods, steel is produced either in Bessemer converters or in electric furnaces. Open-hearth steel is produced by adding pig iron to steel scrap and limestone and heating the mixture in furnaces, which may range in capacity from about 150 to

Keeper observing molten iron being tapped from a blast furnace.

450 tons of steel at one making or "heat." The "open-hearth" process is so named because the conversion of the raw material into steel takes place on the hearth, or floor, of the furnace. This method is used to produce over 85 percent of all steel.

A *melter* (D.O.T. 4–91.444) is in charge of the operation of a group of open-hearth furnaces and is responsible for the quality of the steel produced. Each heat of steel is made to definite specifications to produce different qualities of steel. Therefore, individual instructions must be followed each time the furnace is loaded. The melter must have a practical knowledge of metallurgy; by varying the proportion of the different materials in the furnace and by adding such materials as carbon, manganese, phosphorus, or sulphur, he makes the steel to order. Melters' helpers of different ranks—first (D.O.T. 4–91.445), second (D.O.T. 6–91.183), and third (D.O.T. 8–92.01)—work under the direction of the melter. These helpers regulate furnace temperatures, take samples for laboratory tests, and direct the loading of various materials. A first helper is in charge of one open-hearth furnace.

The *charging machine operator* (D.O.T. 6–91.-181) runs an electrically controlled machine which picks up boxes full of limestone, scrap, and other materials. These machines push the boxes through the open furnace doors and dump the materials into the furnaces. The *molten metal craneman* (D.O.T. 5–73.030), operating a large overhead crane, picks up ladles full of molten iron (which has been removed from the blast furnaces) and pours the contents into the open-hearth furnaces.

After 8 to 12 hours, the heat of steel is ready to be tapped. A second melter's helper, assisted by a crew of helpers, knocks out a plug at the back of the furnace, which allows the molten metal to flow into a ladle just large enough to hold the heat of steel. The slag which floats to the top, overflows into a smaller ladle. The third helper assists the first and second helpers.

The liquid metal is then poured from the ladle into ingot molds. A *ladle craneman* (D.O.T. 5–73.030) operates an overhead crane which picks up the ladle and moves it over a long line of ingot molds (hollow cast iron forms) standing on flat-bottom cars. The *steel pourer* (D.O.T. 4–91.651) operates a stopper on the bottom of the ladle to pour steel into the molds.

As soon as the steel in the ingot molds has solidified sufficiently, an *ingot stripper* (stripper-craneman) (D.O.T. 5–73.010 and .020) removes the molds from the ingots. He operates a crane which grasps lugs on top of the mold and pulls off the mold, leaving the stripped ingot standing to cool.

About 10 percent of all steel is made in Bessemer converters and in electric furnaces. In the Bessemer process, the molten pig iron is refined into steel by blowing air through it, burning out undesirable elements. The converter, a pear-shaped steel vessel lined with fire brick, is tilted horizontally to receive its charge of molten iron. The converter is swung slowly upward, and at the same time air is forced into the molten iron.

A *blower* (D.O.T. 5–92.302) is in charge of the operation of the Bessemer converter. He directs a *regulator* (D.O.T. 6–91.381) in loading the converter and starting the air blast. During the blast, the blower determines the condition of the steel by means of instruments. He shuts off the blast at the right moment and tilts the converter. He directs the regulator in pouring the metal from the converter into a ladle for "teeming" (pouring) into ingots.

Electric furnace steelmaking is becoming increasingly important as a steelmaking process. Highest quality and high alloy steels are generally produced by this process because melting and refining can be more closely controlled. Electric furnaces are steel shells lined with heat-resisting brick. Carbon electrodes project through the roof of the furnace. A powerful electric current "arcing" from one of these electrodes to the other provides heat for refining. The raw-material is usually selected steel scrap, although Bessemer or open-hearth steel may be used. During refining, the required alloys are added and impurities are carried off into the slag.

Rolling and finishing. The third and final step in the production of steel is shaping. The three principal methods of shaping metal in steel plants are casting, forging, and rolling. Casting, done in foundries, consists of pouring molten metal into a mold where it hardens into the shape of the mold. Forging consists of pounding or squeezing softened metal into the desired shape.

Speed operator (one type of roller) oversees the action of a butt weld pipe mill while a helper knocks off scale.

Although a considerable amount of forging and casting is carried on in steel plants, the bulk is done in other industries.

Over 75 percent of all steel products are shaped by the rolling process. In this method, heated ingot steel is squeezed longer and flatter between two cylinders or "rolls."

Before an ingot of steel is rolled, it is heated to the required uniform temperature. The heating is done in large furnaces called "soaking pits." A *heater* (D.O.T. 4–88.081) controls the soaking pit operation. He directs helpers in heating the ingot to the temperature specified by the plant's metallurgist and, by various tests of the steel, determines when it is ready for rolling. A *soaking pit craneman* (D.O.T. 5–73.010) operates a crane to lift the ingot from the soaking pit and to deposit it on a flat-bottom steel carriage, on which the ingot is brought to the rolling equipment. Here, an ingot is rolled into a bloom, slab, or billet. Blooms are generally more than 6 inches wide and 6 inches thick. A slab is much wider and thinner than a bloom. A billet is the smallest of the three. Later, in the finishing phase, blooms, slabs, and billets receive their final rolling and processing.

The rolling of blooms illustrates the semifinishing process. In the blooming mill, as in other rolling mills, the steel moves along on a roller line conveyor. A whistle sounds which tells the *roller* (D.O.T. 5–92.301), the man in charge of the mill, that the ingot is on the conveyor. The roller and his assistants operate the rolling machinery, controlling the speed and direction of the ingot as it passes back and forth through the line of rolling machines. These machines remind one of a giant clothes wringer as they pull the hot steel through its length. After each "pass" through the mill, the rolls are brought closer together and, as a result, squeeze the ingot thinner and longer. The ingot is periodically turned on its side so that its edges are also rolled.

A blooming mill roller works in a glass enclosed "pulpit" above the roller line. His duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple, but actually the quality of the product depends to a considerable degree upon his skill. The roller regulates the distance between the rolls after each pass. This requires long experience and a knowledge of steel properties. (Too much pressure on the roll may result in cracks or tears in the steel, strain in its tensile strength, or breaks in the roll. Too little pressure may result in too long a rolling period, so that the steel may cool below proper rolling temperature.

A *manipulator* (D.O.T. 4–88.012) sits in the pulpit with the roller and operates some of the controls. After perhaps 20 passes, the bloom is sent along the conveyor to a place where a *shearman* (D.O.T. 6–88.664) uses heavy hydraulic blades to cut the steel into proper lengths.

In a blooming mill with automatic process controls, an automatic rolling mill attendant is given a punched card which has coded information and directions on how to handle the ingot to be rolled. The attendant inserts the card into a reader, a control machine. When the ingot reaches the mill, the attendant presses a button that begins a routine which carries out the entire rolling process automatically. The reader determines the number of passes, the amount of turning, and the reduction rate. The roller's function is shifted from operating the rolling controls to direction and coordination of the entire rolling process. This consists of heating, rolling, and shearing.

A similar method of rolling, although the design of the rolling equipment may vary, is used to make various standard steel shapes, such as rail, sheet, or strip.

After the rolling, a substantial amount of the steel is put through "finishing" processes. One such important process is the transformation of steel billet into wire. A second major process is the conversion of solid steel bars into piping and tubing. Another important process is the tinplating of steel to make the "tin" used in tin cans.

An important occupation in wire making is the *wire drawer* (D.O.T. 4–88.511). This worker pulls a tapered rod through a die which forms the wire. The rod end is then attached to a reel which, while revolving, pulls the wire through the die and also winds it around the reel. A key occupation in pipe and tube making is the *piercer machine operator* (D.O.T. 6–88.351). He operates a machine with a bullet-shaped nose. The nose is forced through bar metal to form pipe. In tin making, jobs such as inspector and assorter are performed by women.

Mechanical, Tranportation, and Plant Service Occupations. Large numbers of supporting manual workers are required in steel plants. Some maintain and repair machinery and equipment, and others operate the equipment which provides power, steam, and water. Another group of workers moves material and supplies and performs a variety of plant maintenance and service operations.

In the machine shops, machinists and machine-tool operators make and repair metal parts for machinery or equipment. Die makers use machine tools to construct dies used in wire and cold-drawing units. *Roll turners* (D.O.T. 4–78.011) use lathes, grinders, and other machine tools to finish steel rolls to desired shape and size for use in the rolling mills.

Millwrights install and help maintain mechanical equipment. They set up new machinery and equipment as well as dismantle machinery and repair and replace defective parts. Electricians install electric wiring and fixtures and "hook up" electrically operated equipment. Electrical repairmen (motor inspectors) keep wiring, motors, switches, and electrical equipment in good operating condition and make repairs when equipment breaks down.

Bricklayers (D.O.T. 5–24.130) repair and rebuild the brickwork in furnaces, soaking pits, and coke ovens. Pipefitters lay out, install, and repair piping which is used to carry the large amount of water used in the steelmaking process. Boilermakers test, repair, and rebuild heating units, locomotive boilers, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate steam, diesel, or electric locomotive-driven trains used to transport materials and products in the vast yards of iron and steel plants. Welders operate welding equipment to join together metal parts in repairing and rebuilding plant machinery. Skilled workers run the various boilers, turbines, and switchboards in the powerplants which provide the large amounts of power needed in steelmaking.

Other maintenance and service occupations found in steel plants include carpenter, crane-man, oiler, painter, instrument repairman, scale repairman, loader, rigger, greaser, janitor, and guard. Many laborers are employed to load and unload materials and do a variety of cleanup operations.

(Detailed descriptions of the duties, training, working conditions, and job prospects in many of the mechanical, transportation, and service occupations, such as boilermaker, bricklayer, die maker, carpenter, electrician, machinist, millwright, welder, and pipefitter are included elsewhere in this Handbook. See index for page numbers.)

Administrative, Clerical, and Technical Occupations. The technical and office occupations make up an important part of the industry's labor force. The 30,000 technical workers—who make up about 5 percent of the total employment—apply scientific knowledge to the industry's technology and products. For example, they are now developing alloy steels that are highly resistant to heat, extremely strong, and relatively lightweight for use in space vehicles. One important phase of the industry's work is the continuing research which is directed toward keeping down the cost of steel, improving its quality, and maintaining and even expanding the industry's markets by developing special types of steel needed in modern industry. It is estimated that about 15 percent of the industry's technical personnel are engaged in research.

The technical specialists include mechanical engineers whose principal work in iron and steel plants is in the design, construction, and operation of mill machinery and material handling apparatus. Many mechanical engineers work in operating units where their jobs include, for example, determination of roll size and contour, rolling pressures, and operating speeds. Others are responsible for plant and equipment maintenance. Metallurgists and metallurgical engineers work in laboratories and in production departments where they have the important task of testing and controlling the quality of the steel during its manufacture. They also develop and improve the industry's products and processes through research. Civil engineers are engaged in the layout, construction, and maintenance of the steel plant and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise operation of electrical generating and distribution facilities which provide the power essential in modern steel mill operation. They are concerned also with the operation of electrical machinery and control equipment. Chemists work in the laboratories, making chemical analyses of steel and raw materials used in steel manufacture. Laboratory technicians do routine testing and assist chemists and engineers. Draftsmen prepare working plans and detailed drawings required in plant construction and maintenance. (A more detailed discussion of engineers, scientists, and technicians is given elsewhere in this Handbook. See index for page numbers.)

About 10,000 of the industry's workers are in managerial and supervisory jobs, and about 3,000 are in sales positions. The industry has, in addition, a full complement of administrative workers, such as office managers, purchasing agents, accountants, auditors, and personnel workers. About 72,000 of the industry's employees are clerical workers. Among these are secretaries, stenographers, typists, account clerks, and general office clerks. (Discussion of these jobs can be found elsewhere in this Handbook. See index for page numbers.)

Training and Other Qualifications

New workers for processing jobs are nearly always brought in at the unskilled level, either as laborers or as learners in one of the operating units. Openings in higher rated jobs are filled by upgrading. Training for processing occupations is done almost entirely on the job, with the worker progressively moving to operations requiring greater skill as he acquires experience and "know-how." A craneman, for example, is first taught how to operate relatively simple cranes, and then advances in several steps to cranes much more difficult to run, such as the hot-metal cranes.

Generally, steel companies prefer that new process workers have a high school education. To advance in their work, many workers take part-time courses in such subjects as chemistry, physics, and metallurgy. In many cases, this training is provided by the steel companies and may be given within the plant. Other workers take evening courses in high schools, trade schools, and universities in their communities or enroll in correspondence courses.

Workers in the various operating units usually advance along fairly well defined lines of promotion within their departments. Seniority, ability to do the job, and physical fitness are factors in upgrading. The following illustrates possible lines of advancement in the various operating units:

To become a blast furnace blower, a worker generally starts as a laborer, advancing to cinder snapper, keeper's helper, keeper, blower's helper, and finally to blower. In the open-hearth departments, a man may begin by doing general cleanup work around the furnace and then generally advance to door operator, third helper, second helper, first helper, and eventually, to melter. A possible line of progression for a roller in a finishing mill might be pitman, roll hand, manipulator, rougher, and finish roller. Workers can be trained for skilled jobs, such as blower, melter, and roller (which are among the highest rated steelmaking jobs), in a minimum of 4 or 5 years, but usually need a much longer time to advance to these jobs.

Experienced craftsmen, such as machinists, boilermakers, pipefitters, and electricians, are rarely hired directly by steel companies. Generally openings in the skilled maintenance occupations are filled from within. Most plants conduct some type of apprenticeship program to meet the needs of their maintenance shops. The apprenticeship programs usually are of 3 or 4 years duration and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects is generally given, either in the plant or in local vocational schools.

Qualifications for apprentices vary among companies. Generally, apprentices must be high school or vocational school graduates. In most cases, the minimum age is 18 years; usually an upper age limit of 26 or 30 is specified. Some companies give aptitude tests to applicants for apprenticeship to determine their suitability for the trade. Apprentices are generally chosen from among qualified young workers already employed in other plant jobs. The following occupations are among those most often included in apprenticeship training programs in iron and steel plants: blacksmith, boilermaker, bricklayer, coremaker, carpenter, electrician, instrument repairman, lead burner, machinist, molder, painter, patternmaker, pipefitter, rigger, roll turner, sheet metal worker, tool and die maker, and welder.

Semiskilled maintenance jobs are generally filled by upgrading laborers or helpers. Inexperienced workers are hired as laborers. Some of these workers stay in labor jobs indefinitely.

The minimum requirement for engineering jobs is a bachelor of engineering or a bachelor of science degree from a recognized college. Some companies have formal training programs for college trained engineers in which the trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before assignment to a particular department. In other companies, the newly hired engineer is assigned directly to a specific research, operating, or maintenance unit. Engineering graduates are frequently hired for sales work and many of the executives in the industry have engineering backgrounds. (Training and other qualifications for engineering and scientific occupations are given in the sections covering the individual occupations. See index for page numbers.) Graduates of business administration and liberal arts colleges are employed for jobs in sales, accounting, and labor relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school is usually preferred for entrance in most of the office occupations. Generally, office jobs requiring special knowledge of the steel industry are filled by upgrading personnel already employed in the industry.

Employment Outlook

The iron and steel industry is expected to hire many thousands of new workers in the 1960's. This demand for new employees will occur primarily from replacement needs. Because of the large size of the steel industry's labor force (which numbered about 560,000 in late 1958), retirements and deaths alone should create some 12,000 job openings, on the average, each year during the 1960's. Additional new workers will be needed to replace steel workers who move to other fields of employment.

The steel industry has shown a long term growth. The industry's production and capacity has approximately doubled in the past 30 years. (See table 1.) Employment has shown a much slower growth. During this period, the level of activity in the industry has fluctuated widely with changes in general business conditions and mobilization. The industry's activities rise substantially during periods of prosperity and decline in recessions. This fluctuation occurs because a large amount of steel is used in buildings, automobiles, and machinery products and the sale of these products is particularly sensitive to changes in economic conditions. In response to the business downturn of 1957–58, for example, employment in the fall of 1958 declined to about 20 percent below the same period in 1956. Not all workers in this industry are equally affected by the decline in employment. Office and skilled plant workers are generally less affected than workers in unskilled and semiskilled jobs.

A continued rise in steel production and capacity is anticipated in the 1960's. Contributing factors to this rise are the expected population increase and the greater use of steel per person. Many of the steel consuming industries, such as the automobile, construction, and machinery industries, are expected to require increasing amounts of steel.

During the 1960's, employment is expected to regain the losses resulting from the 1957–58 business downturn and to rise moderately above the 1956 level, although at a slower rate than the

TABLE 1. *Steel production and capacity*

[Thousands—net tons]

Year	Production	Capacity
1905	22, 427	------------
1910	29, 226	------------
1915	36, 009	46, 249
1920	46, 183	60, 220
1925	49, 705	65, 962
1930	44, 591	71, 042
1935	38, 184	78, 452
1940	66, 983	81, 619
1945	79, 702	95, 505
1946	66, 603	91, 891
1950	96, 836	99, 983
1955	117, 036	125, 828
1956	115, 216	128, 363
1957	112, 715	133, 459
1958	85, 300	140, 700

SOURCE: Annual Statistical Report, American Iron and Steel Institute.

estimated 20-percent increase for the Nation's total working population. The rise in employment will not be as rapid as the increase in output because of the continuing rise in output per worker. This increasing efficiency is expected to result from new and improved techniques which are constantly being introduced in steelmaking. Among these important technological developments are the washing and grading of coal used to make coke, the use of controlled air pressure in blast furnaces, and the feeding of oxygen into open-hearth and electric furnaces.

Another factor leading to increasing efficiency in the iron and steel industry is the shift toward more automatic processes in steelmaking. Automatic techniques are now most evident in rolling mills, in tinning processes, in heating furnaces, and sintering plants where ore with increased iron content is prepared. However, this movement toward automation is not expected to occur as rapidly in other phases of steelmaking because of the many technical problems yet to be solved.

These advances in technology are changing the occupational requirements of the industry. As in many other industries, white-collar workers are making up an increasing proportion of the industry's labor force. For example, between 1950 and 1957, the number of nonproduction workers (primarily white-collar workers) rose 35 percent; whereas, production worker employment remained relatively stable. In the future, a greater number of technical workers will be needed. Engineers, chemists, laboratory aids, and other technical personnel are expected to increase as a proportion of the industry's work force. Skilled maintenance mechanics and electronic repairmen are among the plant jobs which will be in greater demand as the industry expands its use of complex machinery and equipment. A continued decline in the number of less skilled processing workers is anticipated.

Earnings and Working Conditions

Earnings of plant workers in iron and steel establishments are among the highest in manufacturing. In April 1959, earnings of production workers in these plants averaged $127 a week or $3.10 an hour. This compares with the $89.87 weekly or $2.23 hourly earnings for production workers in all manufacturing.

Earnings vary considerably among the many occupations. Tables 2 and 3 show standard hourly rates in selected occupations based on the wage agreement effective July 1, 1958 (exclusive of a 16-cent-an-hour cost-of-living adjustment), between the United Steelworkers and the steel-producing subsidiaries of the United States Steel Corp.—the largest single steel company. These rates are representative of those throughout the industry, and serve as a guaranteed minimum for those workers who are paid by the piece (incentive) rather than on a time basis. Since over 50 percent of all process workers are paid on an incentive basis, a majority of process workers generally are earning more than these standard hourly wages. In addition, a wage adjustment is made for changes in the cost of living.

For a number of years, agreements between most steel companies and the United Steelworkers of America have included provisions for vacation, retirement, unemployment, sick and accident insurance, and disability benefits. As of the fall of 1958, most workers received vacation pay ranging from 1 to 3½ weeks based on length of service. Retiring workers are eligible for a combined company-paid and social security pension. As of January 1959, the average retiring worker

TABLE 2. *Wage rates in selected processing jobs, iron and steel industry, July 1958*

Processing job	Job class	Hourly rates
Coke Plants		
Heater	18	$3.032
Pusher operator	12	2.630
Door machine operator	11	2.563
Quencher car operator	7	2.295
Blast Furnaces		
Keeper	14	2.764
Stove tender	14	2.764
Bucket operator; unloader, docks	13	2.697
Ore bridge operator	12	2.630
Iron pourer; pig machine operator	10	2.496
Skip and larry car operator	10	2.496
Keeper's helper, first	9	2.429
Cinder snapper	6	2.228
Steelmaking		
Blower, bessemer converter	26	3.568
Melter's helper, first, open-hearth	23	3.367
Charging machine operator, open-hearth	16	2.898
Ladle craneman, open-hearth	16	2.898
Pourer, first, open-hearth	16	2.898
Melter's helper, second, open-hearth	15	2.831
Charging floor craneman, open-hearth	13	2.697
Ingot stripper, open-hearth	12	2.630
Helper, third, open-hearth	6	2.228
Rolling and finishing mills		
Roller, blooming mill	26	3.568
Butt welder, pipe and tube (1st welder No. 2 butt welder)	21	3.233
Heater, soaking pits	18	3.032
Rougher, hot strip mill	15	2.831
Guide setter, rail mill	14	2.764
Pulpitman; speed operator, finish, hot strip mill	14	2.764
Manipulator, blooming mill	13	2.697
Hot saw man, rail mill	12	2.630
Leverman, first roughing, rail mill	12	2.630
Pickler, sheet batch, tin plate	11	2.563
Coiler operator, hot strip continuous mill	11	2.563
Shearman, blooming mill	10	2.496
Pierce operator, pipe and tube	10	2.496
Wire drawer, continuous, wire mill	10	2.496
Wire drawer, bull blocks, wire mill	8	2.362
Assorters, tin plate	5	2.161
All departments		
Laborer, assigned, such as pig machine laborer or wharfman	3	2.027
Janitors	1	1.960

TABLE 3. *Wage rates in mechanical, transportation, and plant service jobs, iron and steel industry, July 1958*

Job title	Job class	Hourly rates
Toolmaker	18	$3.032
Electrician, first class	16	2.898
Machinist	16	2.898
Boilermaker	15	2.831
Bricklayer, A	15	2.831
Roll turner	15	2.831
Electrical repairman, A, (motor repairman)	14	2.764
Millwright	14	2.764
Rigger, A	14	2.764
Welder, A	14	2.764
Pipefitter	13	2.697
Carpenter	13	2.697
Locomotive engineer, narrow gauge	11	2.563
Painter, A	11	2.563
Switchman	7	2.295
Oiler and greaser, mill oiler	6	2.228
Carpenter helper	5	2.161
Bricklayer helper	3	2.027
Janitor and sweeper	1	1.960

65 years of age with 30 years' service was eligible for a minimum pension of $188 a month. Most workers are eligible for supplemental unemployment benefits for up to 52 weeks. Other important provisions include a $90 monthly disability pension provided by the company and life insurance, accident, sickness, and hospitalization benefits financed jointly by the company and the worker.

Working conditions in mills vary greatly because there is considerable difference in the kinds of work performed in producing steel. Much of the strenuous nature of steelmaking jobs has disappeared with the mechanization of the steel process. Maintenance shops generally are clean and cool. Rolling mills, however, are generally hot and noisy. Some of these plants are developing methods to reduce job discomfort. For example, the use of remote controls enables employees to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the men work, while directing the mechanical equipment, are air conditioned. Much of the work in cokemaking still is physically taxing and requires exposure to heat and dirt. Some of the workers near the blast and steel furnaces are exposed to considerable heat. Because certain processes are operated continuously,

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some workers are on night shifts or work weekends.

The iron and steel industry is a leader in the development of safety programs for workers, emphasizing the use of protective clothing and guard devices on machines to prevent accidents. In 1957, steel plants had an injury frequency rate (injuries per million hours of work) of 4.0 compared with 11.4 for all manufacturing. Approximately 85 percent of the plant workers in the iron and steel industry are members of the United Steelworkers of America union.

OCCUPATIONS IN THE MEN'S TAILORED CLOTHING INDUSTRY

The men's tailored clothing industry employed about 110,000 workers in 1958 to make the suits, sport coats, topcoats, and overcoats worn by more than 70 million American men and boys. In 1957, this industry produced garments valued at more than a billion dollars. Some of the jobs in this industry can be learned in a few weeks; others can be filled only by persons who have had several years of experience or training.

About 90 percent of the workers in this industry were production (plant) workers. This proportion is one of the highest among manufacturing industries. Sewing machine operators were the largest group of production workers in the industry; they accounted for approximately 40 percent (about 37,000) of these workers. Other occupations with relatively large numbers of workers were hand finishers (about 9,500), machine and hand finish pressers (about 7,000), hand basters (about 4,000), thread trimmers and basting pullers (about 3,300), and cutters and markers (about 2,600).

Women, who make up almost two-thirds of the total employment in this industry, work mainly as sewing machine operators. Many also work in other plant jobs, as hand finishers, thread trimmers, and basters, as well as in office occupations. Occupations in which men predominate are cutters and markers, pressers, packers, and work distributors.

Opportunities for new workers to enter this industry will be most numerous in machine-sewing jobs, the largest occupational group. Because employers have had difficulty in hiring enough young Americans for sewing jobs, they have found it necessary to recruit workers from foreign countries.

Nature and Location of the Industry

The men's tailored clothing industry, as described in this chapter, includes only establishments primarily engaged in manufacturing men's and boys' tailored suits, sport coats, topcoats, overcoats, and uniforms. Plants whose principal products are slacks, work garments, sport apparel other than coats, and cotton garments are not considered part of the men's tailored clothing industry, although they employ workers with similar skills.

About 90 percent of all men's and boys' tailored clothing is made by ready-to-wear clothing manufacturers; the remainder are tailor-to-the-trade firms which make garments to order for stores which take individual orders from customers. There are two major types of ready-to-wear clothing plants. The most important is the "inside shop" which performs all, or nearly all, of the manufacturing processes on its premises. Such shops employ a majority of the industry's workers. A few of the largest inside shops own chains of retail stores which market their entire output. The other major type of ready-to-wear clothing establishment is the "contract shop" which specializes in performing one or more tailoring operations, such as sewing or pressing, for manufacturers.

Most clothing firms in this industry are of small or medium size. About four-fifths of the establishments employ less than 100 workers. Only a small proportion of the industry's establishments have 500 or more workers each on their payrolls.

Employment in this industry is concentrated in a few States. Almost 30 percent of the workers were employed in New York State in 1957. Other States with large numbers of the industry's workers were: Pennsylvania, Illinois, Maryland, Ohio, Massachusetts, and New Jersey. More than 20 percent of the workers were employed in the New York City metropolitan area. Other important centers were Philadelphia, Chicago, Baltimore, Rochester, Boston, Cincinnati, and Cleveland. Contract shops are mainly located in areas in and adjacent to New York City, Philadelphia, and Baltimore. With the exception of the New York metropolitan area, all of the men's tailored clothing industry centers employ more women than men.

How Men's Tailored Clothing Is Made

More than 150 distinct operations are required to make a suit, and more than 75 to make a topcoat or overcoat. Some small firms frequently combine several of these operations into a single job. Suits and topcoats are sometimes made in the same plant, but usually a manufacturer specializes in the production of one or the other. Most plants contract out part of their operations, such as the manufacture of pants or linings, or the sponging and shrinking processes, while other plants are completely integrated and perform all the operations involved in the manufacture of a garment.

The manufacturing process varies primarily with the quality of the garments produced. Practically all firms making readymade clothing are graded from 1 to 6, according to the amount of handwork, the quality of the work, and the supervision of the operations being performed. These grades are established by agreements between the Amalgamated Clothing Workers of America and the industry's employers. The higher grade garments involve more hand sewing, pressing, and inspection than the lower grades. Grade 1 suits, for example, are almost entirely machine made, with a minimum of handwork. On the other hand, grade 6 suits have a great amount of hand sewing and pressing. A plant ordinarily produces only a certain grade of garment and generally does not convert to manufacturing clothing of another grade.

Despite these variations, there is a typical manufacturing process which can be described in general terms for a large plant. The following description of procedures followed in manufacturing men's clothing is given as an aid in understanding the kinds of jobs found in this industry.

The manufacturing process begins with the designer who designs a suit and has a sample garment made. If the sample meets the approval of the company's executives, a pattern is made by a patternmaker. This master pattern is then made into patterns of various sizes by pattern graders and the completed patterns are sent to the cutting room.

Meanwhile, the purchasing department has bought the fabric and trimmings, and samples have been tested in the laboratory. After the cloth has been examined and measured, it is sent to the sponging room where it is preshrunk so it will not change shape or texture after the garment is made. The fabric is then dried, finished, and folded or rolled. Most small firms, as well as large firms, often contract these operations to specialized firms.

The first step in the actual fabrication of a garment takes place in the cutting department. The cloth is stretched out on long cutting tables in several layers or "plies"—the number of plies depending upon the quality and number of garments being made. Using the patterns made by the pattern grader as guides, a cutter marks and cuts the cloth. Although cutting is done primarily with machines, some suit and topcoat fabrics are often cut by hand in plants producing high quality garments. The cloth cuttings are then prepared for sewing by fitters who do such jobs as marking locations for pockets, buttons, buttonholes, and belt loops. The garment pieces are then sorted into bundles, with identifying tickets attached, and routed to the various sections of the sewing department where the garment is to be assembled.

Most plants use the bundle system in which the cut pieces are moved through the sewing department in bundles of from 5 to 60 or more pieces. The bundle of cuttings constitutes the unit of work until the final assembly of the garments. Coats and pants are usually assembled in separate departments. The garment begins to take form as it passes through a succession of highly specialized sewing and pressing operations.

Each worker is assigned a specific sewing or pressing task in the assembly process. Some baste linings, join pieces together, or sew tapes around parts which must hold their shape. Some sewers work by hand; and others use a variety of high-speed machines which also cut holes, turn corners, trim edges, and add tapes.

From time to time during these operations, the seams are pressed so that parts will retain their shape and a better fitting garment can be produced. At various stages of production, the garment is inspected for proper workmanship. A final check is often made by a journeyman tailor before the finished garment leaves the plant.

Occupations, Training, Qualifications, and Advancement

The men's tailored clothing industry employs persons who can learn their jobs after a few weeks of training, as well as persons who need several years of experience and training before they can perform their jobs efficiently. About 90 percent of the workers in this industry are production (plant) workers. By far the largest group of plant workers is in machine-sewing jobs. Other large numbers of plant workers are employed in pressing and cutting room jobs.

The physical requirements for production jobs in this industry, in general, are not high, but good eyesight and manual dexterity are essential. Many of the occupations are particularly suitable for handicapped workers, since the majority of jobs are performed while seated and little physical exertion is required. Neither age nor sex is a barrier to employment. Few manufacturing industries have as high a proportion of older workers as the men's tailored clothing industry. Older workers in their fifties or sixties are among the most skilled and productive workers found in many plants. Women are employed in most of the occupations in this industry, although men hold most of the cutting, tailoring, and pressing jobs.

Most plant workers in this industry pick up their skills while working as helpers to experienced craftsmen. The training time required before a new employee in a production job can reach his maximum production speed depends upon the difficulty of the task and the worker's aptitude. Apprenticeship is rare and limited to cutting and tailoring craft jobs. Some private and public schools in clothing manufacturing centers offer instruction in occupations such as machine and hand sewing. A description of the job duties, training, qualifications, and advancement opportunities for selected plant occupations follows:

Designing, Patternmaking, and Pattern Grading Occupations. The *designer* (D.O.T. 0–46.01) originates new style ideas. He prepares rough sketches to illustrate these ideas and submits them to the management for approval. The approved designs are then developed into finished sketches for use by the patternmaker in constructing a master pattern. Since designing is a creative job, designers are permitted to operate independently as long as they originate successful fashions. A large clothing manufacturer usually has 1 designer and 1 or more assistant designers who often have specialized design responsibilities of their own. Most small plants do not employ designers but purchase readymade designs.

The small number of designers now in this occupation entered their jobs in various ways. Some designers were upgraded from cutting or patternmaking jobs. Other designers attended schools, such as the Fashion Institute of Technology in New York City, which specialize in training people for designing occupations. Regardless of method of entry, designers generally first serve several years as assistant designers. Designers often start with small firms and, once their reputations have been established, transfer to jobs in larger, better paying firms.

A designer must have a thorough knowledge of materials and be acquainted with garmentmaking techniques so that he can make, or direct others in the making of, sample garments. A talent for design sketching and the ability to translate fashion ideas into specific patterns are important qualifications for designers.

Patternmakers (D.O.T. 4–27.432) draw and cut out a full-size master pattern for each garment model. The patternmaker works closely with the designer and translates the sketch or model furnished by the designer into the paper or fiberboard pattern pieces. These pieces are used as the patterns from which the finished garment is cut. In making the pattern pieces, the patternmaker must take into account allowances for pleats, yokes, sewing, or shrinkage. The master pattern is then sent to the pattern graders. In some shops, designers or journeymen tailors may make the patterns, whereas in other shops, the assistant designer performs the patternmaking tasks.

Most patternmakers pick up the skills of their trade by working for several years as helpers to journeymen patternmakers. Pattern graders and cutters are occasionally promoted to patternmaking jobs. Patternmaking requires a detailed knowledge of manufacturing processes, as well as a knowledge of body proportions and the characteristics of fabrics. Another qualification for

The patternmaker translates the designer's model or sketch into patterns from which the garment is cut.

this work is the ability to visualize, from a sketch or model furnished by the designer, the size, shape, and number of pattern pieces required.

Pattern graders (D.O.T. 4–27.431) use the master pattern as a model to make patterns for each size. In a sense, a pattern grader is a specialized draftsman who makes the pattern conform to a variety of human figures. His work requires a detailed knowledge of the garments manufactured by his concern as well as a thorough knowledge of standard garments and proportions. Proportion tables of the human body, worked out from years of experience, are used to guide the pattern grader. The completed fiberboard patterns made by the pattern grader are sent to the cutting room, where they are used as guides in cutting out the pieces of cloth for the garments.

Pattern graders are usually selected from employees working in the cutting room or other plant jobs. Training in drafting is helpful, since much of the work requires the use of drafting tools or techniques.

Cutting Room Occupations. The job of the workers in the cutting room is to spread and mark the cloth and cut the pieces needed for the fabrication of the garment. Before marking and cutting, the bolts of cloth are spread out in multiple layers on a cutting table by *spreaders* (D.O.T. 6–27.015 and .016). In some plants, spreaders use manually operated machines, while in other plants they may spread the cloth completely by hand. They lay out the cloth so that defects, which have been previously noted in the cloth, are not included in the parts to be cut out for garments.

Markers (D.O.T. 6–27.011) lay out the patterns of the various garment parts on top of the layers of cloth and then trace the outlines with chalk. The marker lays the patterns close together to avoid wasting cloth, but still leaves space for the cutter to operate. Figured cloth must be marked so that adjoining garment parts will match when the garment is assembled. In small shops, the marker may also perform the duties of the spreader.

Markers must be able to visualize pattern arrangements to get the maximum number of cuttings from a given quantity of cloth.

The job of the *cutter* (D.O.T. 6–27.054) is to cut out the various parts of the garment from the marked layers of cloth which are spread on the tables. The cutter follows the pattern outline working mainly with an automatic cutting tool. Cutters must be able to judge distances accurately and have steady hands in order to follow marked lines precisely because errors in cutting may result in considerable loss of valuable cloth and may alter the final dimensions of the garments. In smaller shops, a cutter may do spreading and marking as well as cutting.

The work of the marker and the cutter is most commonly combined into the single job of cloth cutter and marker.

Fitters or trimmers (D.O.T. 6–27.055) are specialized cutting room workers who sort, match, and trim small garment parts, linings, and tapes. In addition, they prepare cutout garment parts for sewing by marking locations for pockets, buttons, buttonholes, and belt loops.

Most workers enter cutting room jobs by being promoted from other departments. One of the few definite promotional patterns in the industry is found in the cutting department. The usual path of promotion is from spreader, the least skilled job, to cutter or marker. Several years of experience in the cutting room are required before an employee can become a skilled cutter or marker. A small number of the larger plants have apprenticeship programs which usually last 4 years and include all-round training in cutting, marking, spreading, and patternmaking.

Sewing Room Occupations. More than half the production workers in this industry are engaged in some type of machine- or hand-sewing job. Sewers stitch the cuttings together to make parts, such as sleeves, shoulders, and backs, and assemble these parts into finished garments. Workers usually specialize in performing a single operation or group of operations.

About 40 percent of the production workers in the men's tailored clothing industry are engaged in machine-sewing jobs. Most of the employees in these jobs are women. The *sewing machine operators* (D.O.T. 6–27.532) comprise the largest single group of workers in the industry. Sewing machine operators use several types of standard, all-purpose machines similar to those found in the home, or special heavy duty machines designed to perform a single operation at high speed. Special devices, or attachments, such as button-holding clamps, seam-folding attachments, and stitch-guiding devices, are used to facilitate the sewing operations.

Some workers specialize in a single operation, such as attaching collars and cuffs, joining fronts and backs of a garment, or sewing armholes; others make complete collars, cuffs, or pockets. All-round operators or "switchers," who are experienced in using many different machines, are used to replace absent or ill workers, or to assist sections behind in production.

Among the more important sewing machine operator jobs are machine basters, who put in the long loose stitches which hold garments together until permanently stitched; joiners, who bring together the various garment parts; and lapel padders, who stitch padding into lapels.

Some hand sewing is used in all grades of suits and coats, but most *hand sewers* (D.O.T. 6–27.071, .074, and .082) are employed in the plants producing the higher grade garments. The amount of handwork determines the quality of the garment and many of the operations performed by machine in making lower grade garments are done by hand in the production of higher grade garments. The hand sewers use needles and threads of various sizes to perform operations ranging from simple basting to the more complex stitching. Most hand sewers specialize in a single operation, such as basting, buttonhole making, or finishing.

Cutter using machine to cut garment parts from marked plies of cloth.

Entry into beginning hand- or machine-sewing jobs is relatively easy, since little education is required, and there are few restrictions regarding physical condition or age. Usually some previous training in sewing operations is preferred, although many concerns will hire workers with no experience in sewing. Most training is informal and received on the job under the supervision of section foremen or coworkers.

Most sewing jobs require the ability to do painstaking, routine work rapidly. The same sewing operation is repeated on the same gar-

Sewing machine operators make up the largest single group of workers in this industry.

ment part. Since almost all of these workers are paid on the basis of number of pieces produced, any handicap or clumsiness of the fingers, hands, and arms will reduce the worker's earnings. Good eyesight and ability to work at a steady and fast pace are essential for both hand and machine sewing.

The average sewer has little opportunity for promotion beyond that of section foreman, although in some cases, sewers have worked their way up to jobs as production managers. Most sewers stay on the same operation through most of their working life. Sewers are reluctant to change their sewing specialty, since this causes a loss of earnings during the retraining period. However, it is possible for a worker to transfer to a clothing plant making garments one grade below or above the grade on which he was trained without seriously impairing his earnings, provided he performs the same sewing specialty.

Tailoring Occupations. Tailors (D.O.T. 4–26.101 and .201) are skilled hand sewers able to perform all or most of the sewing operations needed to fabricate a garment. There are at least four classifications of tailors recognized in the industry. These are: head tailors, bushelmen, shop tailors, and journeymen tailors.

Head tailors are often known as "quality men," since they are responsible for the quality of the firm's output. They supervise the machine sewers to make certain that shop standards are met, and to insure that garment parts having imperfections are returned to the operator for correction.

Bushelmen repair the manufacturing defects found in the completed garments by the final inspector. They cut loose stitches, trim inaccurately sewed parts, rearrange the padding, and do other necessary corrective sewing.

Shop tailors perform specialized tasks, such as fitting collar facing to the coat, basting the collar to the coat, stitching shoulder padding, or sewing canvas in the various coat parts. Their occupational titles are generally determined by the type of work they do. Thus, they may be called coat basters, lapel padders, or collar setters. Although some shop tailors, through training and experience, may be able to do all-round tailoring, their work, like the work of machine or hand sewers, is generally limited to one or two specific sewing operations.

Most journeymen tailors are employed in custom tailoring shops and the few employed in clothing plants are occupied mostly in constructing sample garments for the designing department. Journeymen tailors make complete tailored garments from the initial design to the final sewing, or perform the more difficult hand and machine work. The journeyman tailor measures the customer for size, designs the garment, and prepares the pattern, using the customer's measurements. He then marks out the pattern, cuts the cloth, assembles and bastes the cut parts, and sews the garment together.

Although some tailors have entered the trade through apprenticeship programs, most of these workers have become tailors after acquiring experience in the less skilled sewing jobs. The skills of the trade are usually learned by working alongside experienced tailors. Training time varies from the few months required to become a shop tailor to the many years of experience necessary to become a head tailor. Generally, men are employed in tailoring jobs.

Head tailors and journeymen tailors must be able to do all the operations involved in constructing a garment and, in addition, be familiar with their firm's quality standards. Since the work of the bushelmen is restricted to correction of defects, they do not require the broad training of the journeymen tailors.

In terms of the skill and experience required, head tailoring is considered the top tailoring job. The possible paths of promotions are from bushelman to journeyman tailor to head tailor. In some cases, journeymen tailors may be advanced to the designing department. The supervisory jobs in clothing plants are often filled by workers who were originally trained as journeymen tailors. Promotion for shop tailors is limited because of the specialized nature of their jobs, although some may have an opportunity to become section formen or bushelmen.

Pressing Occupations. Pressing is one of the most important processes in the manufacture of men's clothing, since the shape and appearance of the finished garment are determined to a great extent by the quality and amount of pressing. Approximately one out of six clothing workers is employed in a pressing job and more than 90 percent of these jobs are held by men. *Pressers* (D.O.T. 7–57.501 and .511) use various types of steam pressing machines or hand irons to flatten seams or to give the required shape to the garment part or finished garment.

There are two basic types of pressers—underpressers who shape and smooth parts during manufacture, and finish pressers who press and smooth a finished part or a completed garment. Underpressers specialize in working on particular garment parts, such as armholes, seams, shoulders, or linings. Their duties vary from simple smoothing of cloth and flattening of seams to the skillful shaping of garment parts. Many of the operations are performed on a steam pressing machine similar to those found in a valet shop. As in underpressing, finish pressers use steam pressing machines and hand irons.

Pressers usually begin as underpressers working on simple seams and single garment parts. After they gain experience they work on more difficult operations and eventually may be promoted to finish pressers. Pressing is one of the few clothing occupations in which workers can find similar jobs outside the industry, and there

Presser using steam pressing machine to shape top coats.

is some transferring back and forth between jobs in the clothing industry and outside jobs. Simple underpressing may be learned in a very short time, although high rates of production may be reached only after several months of experience.

Other Plant Occupations. Many other workers have specialized jobs in the manufacturing process. For example, *shapers* trim and cut various parts of partially completed garments with shears, to shape them accurately and to make them conform to the original pattern. *Assemblers* gather the cut garment pieces into bundles. They match parts according to color or style. *Ticketers* attach identifying tickets to the garment parts before they are sent to the sewing sections. *Work distributors* assign bundles of garment parts to various sections during the work process. *Thread trimmers* or *cleaners* remove loose threads and basting, and brush thread and dirt from the garments to prepare them for final pressing. *Inspectors* determine whether the garments conform to shop standards and, in some cases, perform minor repairs.

Administrative, Clerical, and Related Occupations. The majority of administrative positions are in the production department. The production manager and his assistants are responsible for planning production schedules, issuing work specifications, and supervising the preparation of raw materials and their fabrication into finished garments.

Clerks, bookkeepers, stenographers, and other office workers are employed to keep records and attend to the paper work required in this industry. The men's clothing industry also employs credit managers, accountants, comptrollers, salesmen, and industrial relations personnel, such as are found in other industries. (Discussion of such jobs can be found elsewhere in this Handbook. See index for page numbers.)

Employment Outlook

Little change in the level of employment in the men's tailored clothing industry is expected in the 1960's. However, because a large proportion of the people in this industry are older workers, many job openings will result from the need to replace those workers who retire or die. Another factor which will contribute to future job openings is the large proportion of women in the industry, many of whom may leave their jobs to marry or raise families.

Despite the growing population and rising income level of the last 20 years, the output of men's tailored clothing has increased relatively little. On the average, American men and boys have been purchasing fewer suits, topcoats, and overcoats in recent years. They have substituted sport clothes and cotton garments for the more formal clothing as a result of increased leisure time and the trend toward casual, suburban living.

Since 1948, the number of topcoats and overcoats produced has declined markedly, the number of tailored suits has stayed about the same, and the production of slacks and sport coats has increased greatly. This increased shift to the production of informal leisure wear—primarily slacks—has been an important factor in reducing employment in the men's tailored clothing industry. It should be noted that most slacks are produced in plants not considered to be part of the men's tailored clothing industry. Therefore, their employees are not included in the employment figure for this industry.

Another important factor which has affected demand has been the intense competition for the consumer's dollar by other industries. Studies of consumer spending habits indicate that, during recent years, a slightly declining proportion of income was being spent on men's clothing, and the proportion spent on consumer durable goods, such as automobiles, television sets, radios, and similar goods, was steadily increasing.

Largely as a result of this declining demand, the men's clothing industry has not participated in the great expansion of employment which has occurred in most industries since the beginning of World War II. Since the postwar high of 153,000 workers in 1948, the number employed in this industry had declined to about 110,000 in 1958.

Technological developments have also been a factor in this employment decline. Despite the fact that most of the work performed is done by hand, improvements in factory layout, further specialization of labor, and new machinery have resulted in increases in output per man-hour. Since 1948, the number of garments produced per employee has been steadily increasing.

There are some factors which may, in the future, reverse the trend of declining employment. The heavy birthrate of the war and postwar years should increase the demand for men's tailored clothing in the 1960's, when the largest group of male youths in the history of the country will be reaching adult age. Furthermore, both management and labor are taking active steps to promote the sale of the industry's products by making men more style conscious. However, after taking into consideration all the various factors affecting employment in this industry, little change in total employment is expected in the 1960's.

Employment opportunities will differ among the occupations in this industry. Most opportunities for employment will be in machine-sewing jobs because this is the largest occupational group. Since most of the workers in machine-sewing jobs are women, numerous opportunities should occur to replace the women who will leave the labor force after working temporarily to supplement the family income.

There will be a limited number of opportunities for new workers to obtain designing, patternmaking, and cutting room jobs. These are small occupational fields with little turnover because of the high pay and the status enjoyed by workers in these jobs.

The nature of jobs in this industry is not expected to change radically, since it is much less mechanized than most manufacturing industries. However, new and improved machinery is being introduced which will speed production and reduce the physical and skill requirements of some jobs. For example, new compressed air pressing machines which require less physical effort than the older pressing machines may make it possible to utilize women in these jobs. In addition, the shortage of skilled handworkers is forcing some manufacturers to substitute machine work for hand operations.

Earnings and Working Conditions

Earnings in the men's and boys' tailored clothing industry are not as high as the average for all manufacturing industries. In December 1958, average earnings of production workers in this industry were $62.65 a week or $1.75 an hour, as compared with average earnings of production workers in all manufacturing industries which were $88.04 a week or $2.19 an hour. Production workers in this industry generally worked fewer hours per week than those in manufacturing industries as a whole.

According to a survey conducted by the Bureau of Labor Statistics, earnings of women production workers in nine major centers of production in the men's and boys' tailored clothing industry averaged $1.54 an hour in March 1958. By comparison, men averaged $2.15 an hour. Men had higher earnings largely because more of them were employed in the higher paying jobs. Among the major centers surveyed, the combined average hourly earnings of men and women ranged from $1.58 in St. Louis and $1.67 in Cincinnati to $2.02 in the Los Angeles–Long Beach area and $2.06 in New York City.

About 70 percent of the industry's production workers are paid on the basis of the number of pieces produced by the individual worker. Thus, total earnings in piece rate jobs are largely dependent upon speed as well as skill. Sewing machine operators and hand sewers generally are paid on a piecework basis while workers in the cutting department, inspectors, adjusters, and work distributors usually are paid by the hour or week.

Sewing machine operators, who accounted for about two-fifths of the production workers in this industry, averaged $1.80 an hour in coat fabrication and $1.60 in trouser fabrication, in March 1958. Workers in the "cloth cutter and marker" job category averaged $2.55 an hour, the highest average hourly earnings of all production workers in the industry. Other workers who also averaged more than $2.25 an hour were pattern cutters ($2.37), cloth cutters ($2.34), and lining cutters ($2.31), as well as hand finish pressers ($2.28) and machine finish pressers ($2.27) in coat production. Markers in the cutting departments averaged $2.24 an hour. All-round tailors in coat production and spreaders in the cutting departments averaged $1.96 and $1.62 an hour, respectively. Inspectors earned about $1.50 an hour, and work distributors $1.27 an hour.

The average earnings of designers are far above those of other employees in the industry because of their unique artistic talents. Designers employed by some large manufacturers earn in excess of $15,000 a year.

Paid holidays (most commonly 7 days a year), paid vacations, and health, insurance, and retirement benefits typically were provided to the industry's production workers.

About 90 percent of the production workers in this industry are employed in shops which have agreements with the Amalgamated Clothing Workers of America. These agreements contain provisions which deal with wages; hours of work; vacation and holiday pay; health, insurance, and pension plans; and other employment matters.

The union shop agreement prevails in the industry. New employees in establishments which have union shop agreements are required to join the union after 30 days of employment.

Workers in the men's and boys' tailored clothing industry can expect to lose very little work time resulting from strikes or other work stoppages because the industry is noted for its many years of peaceful labor-management relations.

Where To Go for More Information

Further information on occupations in the men's tailored clothing industry may be obtained from the following sources:

Amalagamated Clothing Workers of America,
15 Union Square, New York 3, N.Y.

Clothing Manufacturers Association of America,
220 Fifth Ave., New York 1, N.Y.

OCCUPATIONS IN THE PAPER AND ALLIED PRODUCTS INDUSTRY

The paper and allied products industry is one of the Nation's major manufacturing industries. Many of the industry's products are essential to our everyday living. These include, for example, paper for books, magazines, and newspapers; paperboard for containers, cartons, and boxes; coarse paper for wrapping; and products used in the home, such as paper towels and facial tissue.

In 1958, the industry employed about 547,000 men and women in a wide range of occupations. Training requirements for the industry's many different jobs vary from graduate degrees for workers employed in scientific and engineering fields to a few days of on-the-job training for some of the unskilled jobs.

Nature and Location of the Industry

The industry described in this chapter includes mills engaged in the manufacture of pulp primarily from wood, rags, and other raw materials; the conversion of the pulp into paper or paperboard; and the conversion of paper and paperboard into many different products, such as coated paper, envelopes, paper bags, paperboard boxes, and packaging. Many of the mills in the industry are integrated, that is, they produce pulp, paper, or paperboard. Some mills specialize in making paper or paperboard from wastepaper and from pulp produced by other mills. Other mills specialize in converting paper or paperboard into commercial products such as envelopes or corrugated fiber boxes.

About 50 percent (269,200) of the workers employed in the paper industry in 1958 were working in pulp paper and paperboard mills. The segment of the industry making finished paperboard containers and boxes employed 149,600 workers, or approximately 27 percent of the total. The remaining 128,100 (23 percent) workers were employed in the production of other finished paper and allied products, such as wallpaper, stationery, paper bags, napkins, toilet tissue, and paper cups.

The paper and allied products industry is composed of relatively large establishments. In 1954, an average of 106 workers was employed in each plant compared with an average of less than 55 workers per plant in all manufacturing. Over a fourth of the more than 5,000 plants in the industry employed 100 or more workers, whereas, only about one-tenth of all manufacturing establishments employed 100 or more workers. Some plants in the paper industry had 1,000 or more employees on their payrolls.

The industry is widely dispersed, with plants in 45 States. Although converting mills are located in almost all of those States, several States have no pulp mills. About half of all the industry's workers were employed in 1957 in seven States: New York, Pennsylvania, Wisconsin, Ohio, Massachusetts, Illinois, and Michigan. Employment in the industry has been expanding more rapidly in the South than in other areas in recent years, primarily because of the development of pulping processes which utilize southern pine and hardwoods.

This industry is one of the most highly mechanized manufacturing industries in the United States. In a series of nearly automatic operations, wood is converted into pulp and pulp into paper and paperboard. As described in the following section, paper is manufactured with a minimum of handling by the production worker.

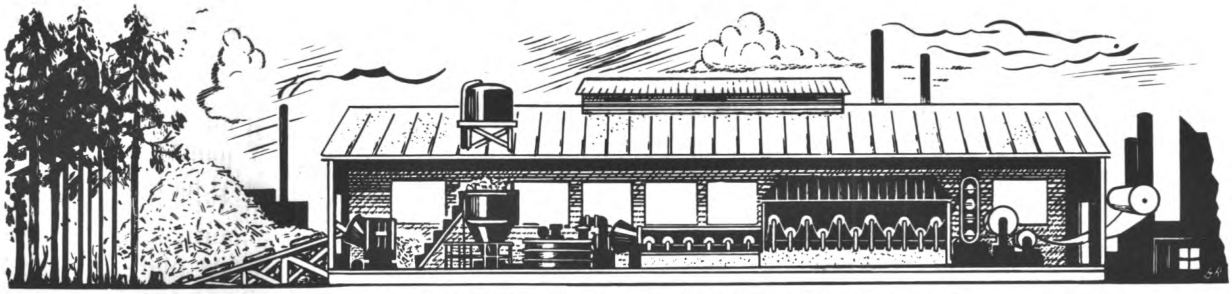
How Paper Is Made

Before paper can become a finished product, such as a page in a book, it must go through many complicated processes. The manufacturing methods used in the production of paper depend primarily upon the raw material used, the type of paper product desired, and the equipment available.

The following simplified description of the papermaking process will lead to a better understanding of the nature of the jobs found in the industry. Because of the great variety of the product and the differences in manufacturing

CHART 44

THE PAPERMAKING PROCESS



UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

processes, only a general description can be given.

Paper is generally not produced in one continuous operation. However, the manufacture of paper and paperboard can be divided into three major processes: the pulping process, the manufacture of paper and paperboard from pulp, and converting the paper and paperboard into finished products. The description which follows applies to an integrated mill which typically receives the pulpwood (logs about 4 feet in length), or other raw materials, reduces this material to pulp, and converts the pulp into paper—all in one continuous operation. (See chart 44.) Twelve hours or less may elapse from the time that logs or other raw materials enter the pulp mill to the time they are converted into finished rolls of paper.

The Pulping Process. The major raw material of paper is cellulose fiber—the material which forms the cell walls of the bodies of all plant life. The most abundant and compact source of cellulose today is wood. The purpose of the pulping process is to reduce logs or other raw materials to cellulose pulp.

When the pulpwood is received by the mill, it must be thoroughly cleaned of bark, bark particles, and other dirt. The logs which arrive in the woodyard are carried on conveyors to large revolving cylinders or barking drums, where the bark is stripped from the wood as the logs tumble against each other and the rough inner surface of the drum. The debarked logs fall onto a conveyor which carries them to a chipper. The chipper is a large rotating disc with many sharp knives mounted on its face which reduces the logs to wooden chips, pieces of wood the size of a nickel. The chips are then conveyed on rubber belts to a storage bin from which they may be drawn as needed.

The wooden chips are now ready for the process which separates the cellulose from the sap, minerals, and other substances not needed for the papermaking process. This is done either by a chemical or mechanical process, or a combination of both, depending on the type of wood and the grade of paper desired. In the chemical process, which is most commonly used, the wood chips are cooked in digesters (large closed vessels) under high pressure and temperature in a chemical solution. The cellulose which has been separated is then thoroughly washed to remove chemicals, undissolved wood, and other foreign matter. The final product is a clean, uniform mass of fibers called pulp.

Pulp that is to be put in storage (or shipped to other paper mills in the case of a nonintegrated operation) is generally run through machines to remove most of the moisture and is pressed into flat sheets which can be shipped or stored more conveniently and economically. The pulp, in a liquid suspension, which is to be used immediately may be pumped through large pipes to the department which turns the pulp into paper and paperboard or may be made into bundles (wet laps) and stored.

Manufacture of Paper. The first step in making paper is the beating and refining of the pulp so that the fibers will mat easily when being formed into the sheet on the paper machine. Dyes and chemicals are added which determine the color and other final characteristics of the paper. The pulp, which is suspended in water, then flows through other refining machines into the papermaking machine.

The machines used to produce paper are among the largest found in all American industry. Some of them are longer than a city block and cost several millions of dollars. The machines are of two basic types. One is the Fourdrinier, named after the brothers who first manufactured it. The other is the cylinder machine. On the Fourdrinier Machine, the pulp solution pours on a moving endless belt of wire cloth. Water is removed by drainage, suction, and evaporation, so that the pulp becomes a loosely matted web. After passing through presses to squeeze out more water, the web passes through the drier section which consists of a number of steam heated cylinders, which remove the remaining moisture.

The cylinder process used primarily in the production of paperboard is similar to the Fourdrinier, differing only in the wet or sheet forming end where cylinders are used with a moving wire screen.

At the end of the papermaking machine, the paper sheet passes between heavy polished rolls which make it smooth and glossy. The finished paper is then wound automatically upon reels, and is ready for the finishing or converting mill or department where it is made into the thousands of paper items used throughout industry and in the home.

Finishing and Converting. Paper for books and magazines is prepared for final sale in the finishing department. The huge rolls of paper which comes from the papermaking machine is slit into smaller rolls and rewound on a machine called a rewinder. Other machines called cutters, are used to trim the rolls of paper into sheets. The best grades of paper are cut on a guillotine. This machine has a magnifying glass on the cutting gage to insure accurate cutting and the operator must use great care in trimming the sheets. These sheets are then carefully inspected for such defects as dirt spots and wrinkles and are then wrapped for shipment.

The operations in converting plants differ widely, depending on the end product being manufactured. An example of a typical converting operation is the manufacture of folding cartons from corrugated paper. This paper is produced in a machine which binds three pieces of paperboard. In this process, the machine puts furrows and paste on both sides of the center sheet and sandwiches it between the other two sheets of paperboard. The rolls of corrugated are then placed in another machine that cuts, creases, and folds the corrugated board to form shapes that can easily be set up by consumers to form cartons.

Occupations in the Paper and Allied Products Industry

Workers with many different levels of skill and education are employed in the paper and allied products industry, with the largest proportion working in plant occupations. Because of the technical nature of pulp and papermaking, the industry also employs chemists, chemical and mechanical engineers, laboratory assistants, material testers, and inspectors. Many administrative and related personnel, such as purchasing agents, accountants, personnel officials, and salesmen are also employed, as are many clerks, stenographers, bookkeepers, and other office workers.

About 115,000 women worked in this industry in January 1959. Many were employed in office jobs, as bookkeepers, clerks, stenographers, and office machine operators. Most of the women employed in the production processes worked in the finishing and converting operations; few were employed in the pulping process or in paper manufacturing operations.

Plant Occupations. Pulp and paper mill workers employed in plant jobs can generally be divided into three major occupational groups: Production workers who operate the various machines and equipment; maintenance workers who maintain, install, and repair machinery, pipes, and equipment; and other workers, such as material handlers and stock clerks. Because so many of the industry's production processes are performed automatically with the use of conveyors, pumps, special machines, and other mechanical equipment, the principal job of most plant workers is to operate, control, and maintain machinery and equipment. These equipment operators and their helpers make up the largest single occupational group in the pulp and paper industry.

Most of the jobs in the pulping operation are semiskilled and unskilled. Many of these jobs are not unique to this industry. For example, bulldozer operators and truckdrivers are not only employed in pulp and paper mills, but in many other manufacturing establishments. An example of a semiskilled job which is unique to this industry is that of the *barker operator* (D.O.T. 6–41.011) who is in charge of the operation of a machine which removes bark and dirt from the logs. He feeds logs into the machine by hand or by mechanical means and starts and stops the barking machine. The *digester operator* (D.O.T. 4–41.050) is an example of a skilled worker unique to the operation and to the industry. He is in charge of the large kettle-like vessels called digesters which break down the wood chips through chemical action, heat, and pressure to make pulp. He determines the amount of chemicals to be used and the cooking pressure, directs the loading and filling of the digester with chips and chemicals, and watches an instrument panel to determine when the contents are ready for removal.

Some of the more highly skilled operating jobs are found in the papermaking department. For example, the *paper machine operator* or *machine tender* (D.O.T. 4–41.420) is a key worker who regulates and controls the flow of pulp onto the paper machine. In addition to supervising the less skilled workers and the helpers of the machine crew, the operator is responsible for the width, thickness, and moisture content of the paper. He produces paper according to specification by setting and adjusting presses, and, in some cases, through sight and feel. He must constantly observe control-panel instruments in order to control the flow of the pulpy mass through the machine and regulate the speed of the machine to obtain paper of the desired specifications. He interprets tests of samples of paper. With the aid of the rest of the crew, he replaces the wires and belts upon which the sheet of paper is formed. The quality of the final product depends to a large degree upon his skill and experience.

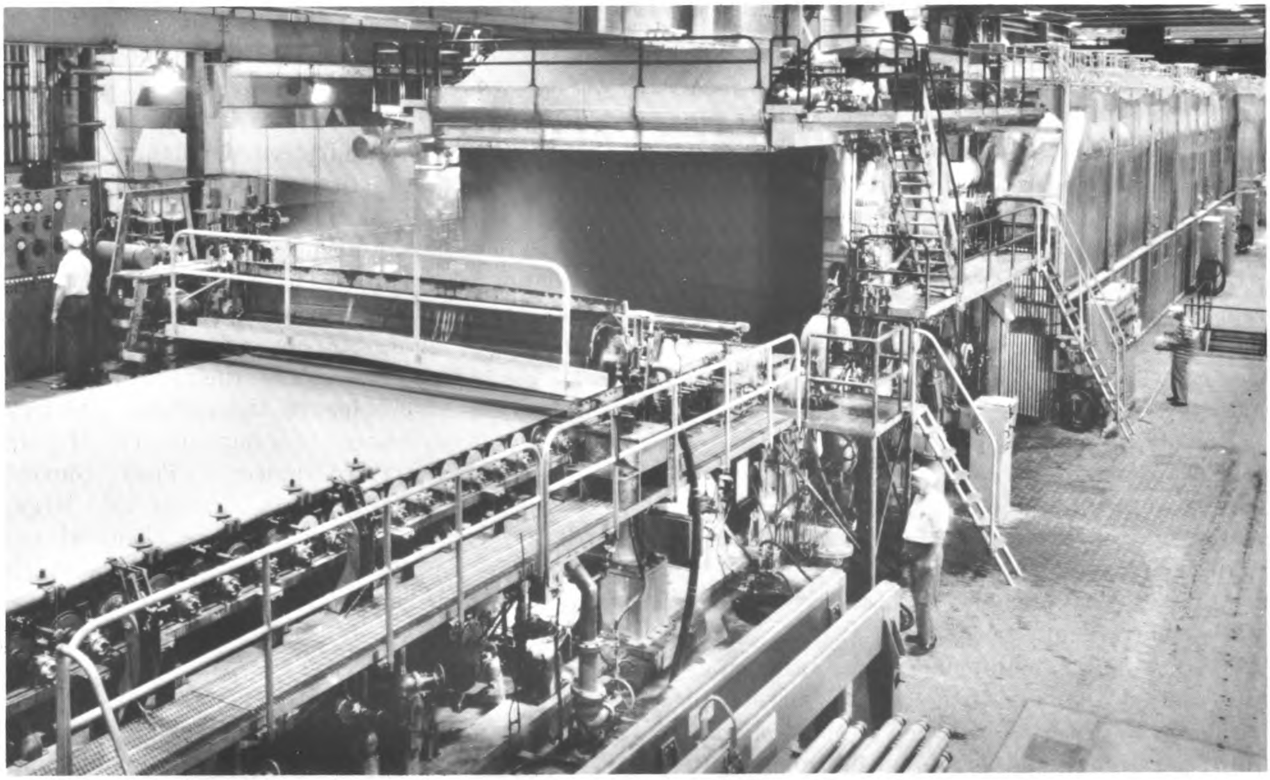
A back tender (D.O.T. 6–41.420) is a semiskilled worker who controls the dry end of the Fourdrinier and works with the machine tender. He leads the paper to and over driers and regulates the heat of the driers. The rolls are adjusted by the back tender to obtain the proper finish and thickness of paper. He checks the paper for imperfections and controls the speed of the roll so that the paper will be tightly wound. Several other workers assist the back tender. The number of assistants varies according to the speed of the paper machine and the width of the finished roll.

In many paper mills where a fine grade of paper is produced for books, magazines, or for stationery and other writing purposes, a finishing department is maintained. Most of the jobs in this department are either unskilled or semiskilled. For instance, the *supercalender operator* (D.O.T. 6–41.450), with several helpers, places huge rolls of paper on a machine that will give it a smooth and glossy finish. He must also inspect the finished product to make sure that specifications are being met. Another worker in the finishing department, the *paper sorter and counter* (D.O.T. 6–41.940), will have among his responsibilities the inspection of sheets of paper for any defects, in addition to counting the number of sheets.

In the finishing and converting operations, most plant jobs are semiskilled or unskilled. Many of the workers in these jobs operate the large number of specialized machines which are used to convert the paper or paperboard into envelopes, boxes, cartons, or other paper products for ultimate consumption.

The *corrugating operator* (D.O.T. 6–42.932) is responsible for tending the machine which makes corrugated (paperboard with alternate ridges and grooves) packaging material used largely in the manufacture of boxes. He regulates and controls the speed of the machine so that the layers of paperboard which are glued together will be formed into sheets.

One of the typical semiskilled machine operating jobs found in a converting plant is that of the *envelope machine operator* (D.O.T. 6–42.621). The operator feeds and tends an automatic ma-



Machine tender and his helper regulate and control the flow of pulp onto the papermaking machine.

chine that makes envelopes from die-cut blanks. He loads stacks of blanks into the automatic feeding device of the machine and sees to it that the machine is supplied with the proper amount of glue of correct consistency.

Among the few skilled jobs in a converting installation is that of the *printer slotter operator* (D.O.T. 4–42.315) who sets, adjusts, and operates a machine which cuts and creases corrugated or paperboard sheets to form box blanks and prints designs on box blanks. The operator positions the printing dies and cutting devices. He turns valves to control distribution of ink to cylinders, pressure of rollers, and speed of machines.

Another skilled job is that of the *die maker* (D.O.T. 4–42.301) who is employed by companies which make folding cartons. This skilled worker makes cutting dies from wood and metal from blueprints prepared under the direction of the packaging engineers. The dies are used on machines which cut the paperboard to the desired shape. To print the lettering, designs, and colors on containers and boxes, several thousand skilled *compositors and typesetters* also are employed in this segment of the industry. The job duties of these workers are similar to those found in printing establishments. (See index for chapter on Printing Occupations.)

Because the pulp and paper industry uses a considerable amount of mechanical and electrical equipment which is subject to wear from high temperatures, pressure, and chemical reactions, the industry employs many skilled maintenance workers. (A detailed discussion of the duties, training, and employment opportunities of the following maintenance jobs appears elsewhere in the Handbook. See index for page numbers.) One of the important maintenance occupations is that of the *millwright.* This skilled worker dismantles and reassembles machines and equipment when they are moved around the plant. He maintains and repairs machinery and equipment and examines paper machine rolls, bearings, pumps, and other parts to insure all are in proper working condition.

Other maintenance workers employed in this industry are *electricians* who repair wiring, motors, switches, and other electrical equipment and *maintenance machinists* who produce replacement parts for mechanical equipment. Another important maintenance job is that of the *pipefitter* who lays out, installs, and repairs pipes.

The industry also employs *instrument repairmen* to install and repair the electrical, electronic, and mechanical instruments which regulate, record, and control the flow of pulp and other paper processes. The job of the instrument repairman is becoming increasingly important in pulp and paper manufacturing because of the growing use of automatic controls in this industry.

Because pulp and paper plants use considerable electrical energy, they often maintain their own powerplants. The *stationary engineer*, who operates and maintains engines and mechanical equipment, such as steam engines, boilers, air compressors, motors, and turbines, is in charge of the powerplant.

In some plants, maintenance jobs are combined into a single job involving general maintenance mechanic duties. (A detailed discussion of the duties, training, and employment opportunities in maintenance jobs appears elsewhere in the Handbook. See index for page numbers.)

Jobs not related to the operation or maintenance of pulp and papermaking equipment are found in plant occupations. For example, the industry employs truck and tractor drivers to make deliveries to and from plants. Other workers load and unload material on trucks, trains, and ships. Workers are also employed in the plants to keep inventory records of stock and tools. Custodial workers, such as guards, watchmen, and janitors—whose jobs are similar to those in other industries—make up part of this industry's labor force.

Professional and Technical Occupations. The increasing complexity of pulp and paper manufacturing requires the employment of many thousands of workers with chemical, engineering, or other scientific training and education. According to a 1957 Bureau of Labor Statistics survey of scientific manpower in American industry, about 8,400 engineers and scientists were employed by pulp and paper manufacturers. In recent years, the trend has been to employ chemists and engineers (called paper chemists or paper engineers) who have had specialized training in the technology of the paper industry.

Some of the industry's *chemists* work in research laboratories, but a large number are employed in the production departments where they control the quality of the product by supervising the testing of materials during processing. Other chemists are also employed as supervisors of plant workers. The industry employs chemists as technical salesmen or as administrators in positions which require technical knowledge.

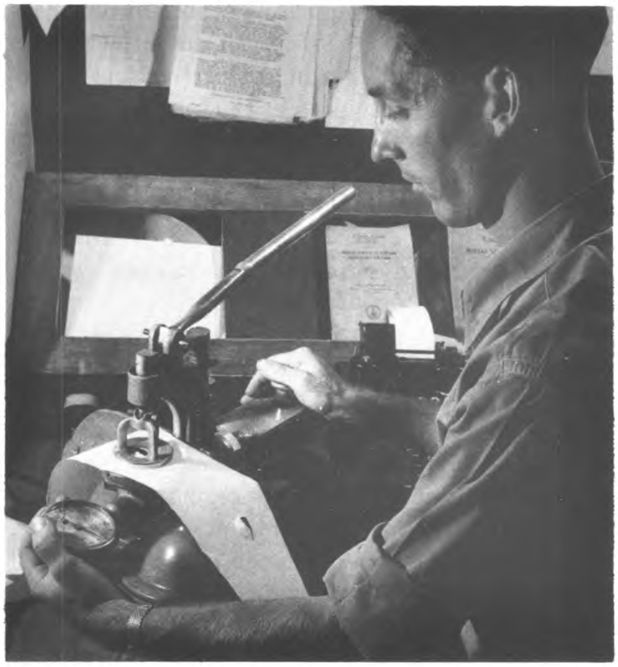
Chemical engineers apply their chemical and engineering knowledge to the design, construction, operation, control, and improvement of pulp and papermaking equipment. They convert processes developed in the laboratory into large-scale production methods. Some chemical engineers are employed in supervisory jobs which require knowledge peculiar to the industry.

Electrical engineers, who are concerned with the use of instruments in the papermaking processes, power generation and distribution, and the design and development of electrical and electronic machinery are employed by pulp and paper manufacturers.

Packaging engineers (D.O.T. 0–68.60) are employed to design and supervise the production of paperboard boxes for special packaging problems. A few box manufacturers also employ artists who work out the lettering, design, and color for the containers they produce.

Many pulp companies own large areas of timberland and employ professionally trained *foresters* to operate them. Even those who purchase their pulpwood in the open market employ foresters in their wood procurement operations. (A detailed discussion of the duties, training, and employment opportunities for foresters appears elsewhere in the Handbook. See index for page numbers.)

Throughout the manufacture of pulp, paper, and allied products, frequent testing is performed to determine weight, strength, color, consistency, finish, and size. Some of this work is done by the machine operator but, in many mills, testing technicians are employed in special testing laboratories where they utilize various types of chemicals and mechanical testing equipment. These employees, who have job titles such as *laboratory technicians*, *paper testers*, *pulp testers*,



Paper inspector testing the bursting strength of a newly made sheet of paper.

paper inspectors, and *chemical analysts*, assist professional chemists and engineers in research and development work and in production control. They may perform simple routine tests or do highly technical or analytical work, depending on their training and experience. Much of the work of the laboratory technicians, for example, consists of conducting tests and recording the results in the form of charts or graphs for interpretation by chemists and chemical engineers. (See chapter in Technicians for more detailed description of work performed by semiprofessional workers.)

Administrative, Clerical, and Related Occupations. The pulp and paper industry employs a wide variety of administrative, clerical, and selected personnel. Many of the higher level administrative and management positions are filled by technically trained men. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, types of products to manufacture, and location of plants. To make such decisions, the executives require the help of a large group of specialized personnel. Some of these specialized workers include accountants, purchasing agents, sales representatives, lawyers, and personnel employed in such activities as industrial relations, public relations, transportation, advertising, and market research. Clerical employees who keep personnel, payroll, raw material, sales, shipments, and plant maintenance records are also employed in this industry.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the paper and allied products industry range from a few days of on-the-job training to years of preparation. Many of the operating jobs can be learned after a few days to a few weeks of training. On the other hand, the engineering and scientific jobs, as well as maintenance jobs and a few machine tending jobs, require years of training.

The industry generally hires inexperienced workers for processing jobs and training is done on the job. Many companies prefer to hire high school graduates between the ages of 18 and 25. Production workers usually start as laborers or helpers and advance along fairly well defined lines of progression to more skilled jobs.

Maintenance jobs are generally filled by men trained in the plant. However, when shortages exist or when there are no qualified workers in the plant, maintenance jobs are sometimes filled by hiring experienced men from outside the plant. Most companies in this industry do not have formal apprenticeship programs to meet the needs of their own maintenance shops.

In recent years, some of the large integrated plants have started formal apprenticeship programs which require 3 or 4 years of training. Young men in the apprenticeship programs may be trained for craft jobs, such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and other qualifying tests. Apprenticeship training includes both on-the-job training and classroom instruction related to the occupation. For example, mathematics, blueprint reading, shop theory, and specialized subjects are studied in the classroom by the machinist apprentice. The apprentice also learns the operation and use of the tools of his trade in shop training.

A bachelor of science or a bachelor of engineering degree from a recognized college is usually the minimum educational requirement for scientists and engineers employed by the industry. For research jobs, persons with advanced degrees are preferred. Many schools, such as Lawrence College (The Institute of Paper Chemistry) in Appleton, Wis.; Oregon College, Corvallis, Oreg.; Lowell Technological Institute, Lowell, Mass.; Miami University of Ohio, Oxford, Ohio; and the Universities of Alabama, University, Ala.; Florida, Gainesville, Fla.; Maine, Orona, Maine; Western Michigan, Kalamazoo, Mich.; North Carolina, Greensboro, N.C.; Oregon, Eugene, Oreg.; Syracuse, Syracuse, N.Y.; and Washington, Seattle, Wash.; offer specialized courses in papermaking. Generally, students specializing in papermaking are hired for summer work and, upon graduation, are often hired on a permanent basis by the company. The industry offers scholarships to students interested in pulp and papermaking technology.

Some companies have formal training programs for young college graduates with engineering or scientific backgrounds. These employees may work for brief periods in the various plant operating divisions to gain a broad knowledge of pulp and paper manufacturing before being permanently assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research operation or maintenance unit.

Generally, no specialized education is required for jobs as laboratory assistants or pulp or paper testers. Training for the most part is on the job. Laboratory assistants, for example, begin their work in routine jobs and advance to positions of greater responsibility after they have acquired additional experience and demonstrated their ability to work without close supervision. Technicians who have had technical institute or junior college training are preferred for these semiprofessional jobs by some employers.

Administrative positions are frequently filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. For positions as clerks, bookkeepers, stenographers, and typists, most pulp and paper companies employ persons who have had commercial courses in high school or in business school. A knowledge of paper manufacture is sometimes helpful for administrative, sales, clerical, and related occupations. This is especially true of sales jobs where it is often necessary to give customers technical assistance.

Seniority and performance on the job are factors in upgrading. Promotion in plant jobs is generally from within a "work area" which may be a department, section, or one machine operation, such as a papermaking machine. For example, to become a paper machine tender, the worker may start as a laborer handling the rolls as they come off the machine. As he gains experience and know-how, he moves to more difficult assignments—finally becoming machine tender in charge of the operation of the machine. This takes many years, depending on the skill of the worker and the availability of openings. Experience gained in a "work area" is generally not transferable; workers who transfer to jobs outside their seniority area or to other plants usually lose their seniority and must start again at entry jobs.

Many plant foremen and supervisors are promoted from the ranks. In large plants, applicants for foreman jobs may go through a preliminary training period before they are eligible for promotion to the foreman level. This training is often continued after the worker is promoted—through conference, special plant training sessions, and, in some cases, by taking courses at universities or trade schools.

Employment Outlook

Many thousands of new workers will be able to find jobs in the paper and allied products industry during the 1960's. Employment, which increased about 16 percent (473,000 to 547,000) from 1948 to 1958, will probably rise at about the same rate in the 1960–70 decade. In addition to the number of jobs arising from the anticipated expansion of the industry, a large number of job openings will result from the need to replace workers who retire, die, or transfer to other fields of work.

The paper and allied products industry is one of the Nation's more rapidly growing manufacturing industries. Employment in this industry, however, has increased at a slower rate than production. The industry has been able to expand its production without a corresponding increase in employment principally because of its continuing use of larger and more efficient processing machinery and more automatic control equipment. Although further technological advances are expected to speed up and improve the paper industry's production processes, overall employment should increase as a result of the growing demand for the industry's products.

The expected growth in employment is based upon an analysis of the factors which affect the demand for the industry's products. New paper products are constantly being developed. For example, the commercial introduction of new products, such as stretchable paper, is expected to increase greatly the use of paper. Paperboard containers are being substituted for wooden boxes, metal drums, and other shipping material. Many products which were formerly shipped without protection are now being enclosed in corrugated and solid fiber boxes. The growing popularity of the self-service retail store has increased the number of prepackaged items and expanded the demand for paper products. As a result of these developments, there was a 60-percent increase in the number of pounds of paper used per person in this country between 1940 and 1958 as shown in the following tabulation:

	Pounds consumed per capita
1940	254.0
1945	281.8
1950	382.5
1951	396.0
1952	369.6
1953	391.1
1954	383.7
1955	421.0
1956	434.4
1957	412.9
1958	406.0

Source: American Paper and Pulp Association.

The anticipation of increased economic activity, rising levels of consumer income, and a continued growth in population in the 1960's should result in a greater demand for the industry's products. In addition, the expected rapid growth in school enrollments and higher levels of education should bring about a greater demand for textbooks, writing paper, books, newspapers, and periodicals.

Different rates of growth are expected for the many occupational groups employed in the pulp and paper industry during the 1960–70 decade. For example, the number of engineers, scientists, and other technical personnel in this industry is expected to increase at a faster rate than other occupational groups because of the anticipated expansion of research and development.

The employment of skilled workers, such as electricians, machinery repairmen, carpenters, pipefitters, and millwrights who do installation and maintenance work will also grow at a relatively faster rate than other occupational groups during the decade of the 1960's. Semiskilled and helpers, laborers, and other unskilled plant workers will probably increase at a slower rate than total employment.

The employment of clerical and administrative workers will probably increase at a faster rate than production employment. The need for office workers, such as stenographers, typists, business machine operators, and bookkeepers is expected to continue to increase in the next decade.

In addition to job openings arising from the anticipated growth of this industry, many thousands of new workers will be needed to replace those who die, retire, or transfer to other fields of work. Retirements and deaths alone are expected to create between 10,000 and 13,000 new openings each year during the 1960's.

Earnings and Working Conditions

Production workers in the paper and allied products industry averaged $2.18 an hour or $93.09 a week in April 1959. In the same month, production workers in all manufacturing industries averaged $2.23 an hour or $89.87 a week.

Some highly skilled machine operators and many of the maintenance workers have the highest paying plant jobs. For example, in 1957 a few skilled paper machine tenders earned more than $4 an hour, and many journeymen maintenance workers were receiving more than $2.50 an hour.

Current wage data for individual occupations are not available for this industry. However, the following data collected from a number of 1957 union agreements illustrates the approximate range of hourly wage rates for selected occupations.

Pulping operation	*Hourly rate ranges*
Crane operator	$1. 70–$2. 95
Barking drum operator	1. 80– 2. 25
Cook (digester room)	1. 80– 2. 95
Wet room operator	1. 75– 2. 90
Laborer	1. 45– 1. 90
Papermaking operations	
Beater operator	1. 80– 1. 95
Jordan operator	1. 95– 2. 00
Paper machine tender	2. 95– 4. 20
Paper tester	1. 80– 2. 15
Rewinder man	1. 45– 3. 45
Maintenance jobs	
Millwrights	2. 05– 3. 00
Machinists	2. 05– 3. 00
Painters	1. 50– 3. 00
Carpenters	1. 70– 2. 85
Pipefitters	2. 05– 3. 00
Electricians	2. 05– 3. 00
Welders	2. 05– 3. 00
Instrument repairmen	1. 55– 3. 10
Corrugated box jobs	
Corrugator machine operator	1. 55– 2. 60
Ream cutter	1. 50– 2. 60
Printing pressman	1. 65– 3. 85
Die maker	1. 90– 2. 80
Starch machine mixer	1. 40– 2. 20
Stitcher machine operator	1. 25– 2. 25
Bundler	1. 30– 2. 10

The starting salaries for chemists, engineers, and other professional personnel depend upon the size of the company, the particular specialization, and the academic degree. A 1957 survey conducted by the American Chemical Society indicated that the entry salaries for chemical engineers in the paper industry were among the highest for all industries surveyed. Half of all the engineers who entered the industry in 1957 averaged more than $460 a month. Several mills reported paying starting salaries of $450 per month for chemists. Chemists and all engineers with graduate degrees generally received higher starting salaries. For example, some companies were paying chemists who had a doctor's degree a starting salary of $600 a month.

Many of the workers employed in pulp and paper producing operations work in plants that operate around the clock—3 shifts a day and 7 days a week. Owing to the widespread industry practice of rotating shifts, production workers can expect to work the evening or night shifts at one time or another. However, maintenance workers, for the most part, are employed on the regular day shift. Virtually all plants pay a differential for working the evening or night shift. Most plants commonly pay between 5 and 10 cents an hour more for the evening shift and between 10 and 15 cents an hour extra for the night shift. Work in the industry is subject to few seasonal variations and most workers generally have year-round employment.

A work schedule of 40 hours a week for first-shift workers was in effect in 1958 in most mills. A small part of the industry has a standard workweek of 35 hours or less.

Paid vacations are almost universally provided and are generally based on length of service. In practically all mills, workers receive 1 week of vacation after 1 year of employment, 2 weeks after 3 to 5 years, and 3 weeks after 10 or more years of employment. Many companies give 4 weeks' vacation to employees who have been with them 25 years or more. Nearly all plants grant paid holidays; the number of days range from 6 to 8 a year, with most mills granting 6 paid holidays.

Insurance or pension plans, financed at least partially by employers, were in effect in the majority of all plants. These plans include life, sickness, accident, hospitalization, and surgical insurance. Employee stock-purchase plans and savings plans to which the company makes contributions are in effect in some firms.

There is considerable variety in the working conditions in this industry. Most pulp and papermaking jobs do not require strenuous physical effort. Some employees, however, work in areas which are hot, humid, and noisy. They are also exposed to disagreeable odors which come from the chemicals used in the papermaking process. Pulp and paper companies, however, have made intensive efforts in recent years to reduce heat and unpleasant odors by the introduction of improved ventilating systems.

In the past, the average number of injuries occurring in the industry has been slightly above the average for all manufacturing. However, intensified safety programs have recently resulted in a reduction in the number of injuries.

Some of the more hazardous jobs are in converting plants where many cutting tools and moving equipment are used. Safety measures such as protective clothing, placard warnings in danger areas, locking devices on potentially dangerous equipment, and guards and rails around moving machinery have been instrumental in reducing the accident rate.

A majority of the workers in this industry are members of trade unions. A large number belong to either the International Brotherhood of Pulp, Sulphite and Paper Mill Workers or the United Papermakers and Paperworkers. In addition, the craftsmen in the industry belong to various craft unions.

Where To Go for More Information

Further information concerning the paper and allied products industry can be obtained from the following sources:

American Paper and Pulp Association,
122 East 42d St., New York 17, N.Y.

Fiber Box Association,
224 South Michigan Ave., Chicago 4, Ill.

National Paperboard Association,
80 East Jackson Blvd., Chicago 4, Ill.

PETROLEUM PRODUCTION AND REFINING OCCUPATIONS

Modern civilization is dependent upon the products of the petroleum industry. From this industry come the fuel to run the millions of cars and trucks and great fleets of military and civilian aircraft; the oil to heat several million homes and provide power for thousands of locomotives and ships; the lubricants for machinery in factories; the asphalt to cover thousands of miles of highways; and hundreds of other products ranging from insecticides to plastic materials.

The petroleum industry is an important field of employment. Petroleum production and refining, the segments of the industry covered in this report, together provided jobs for about half a million wage and salary workers in 1958. (Because current employment data are not available for workers engaged only in crude petroleum production, these figures include workers engaged in both crude petroleum and natural gas production, as well as refining.) Production and refining offer job opportunities to workers with a wide range of skills and interests. Earnings in the petroleum industry are high and jobs are located in many different parts of the country.

Nature and Location of the Industry

There are thousands of companies in the oil business, most of them specializing in a single activity such as exploring for oil; drilling wells; producing, transporting, or refining oil; or operating service stations. The bulk of the oil business, however, is done by a limited number of large firms that conduct all activities from exploring to marketing. These "integrated" firms provide a large share of the industry's jobs.

This chapter deals exclusively with the activities of getting the oil to the surface of the earth (production) and converting it to usable products (refining). It excludes transporting and marketing oil products. It contains no discussion of workers engaged in the production of natural gas or natural gasoline which is often associated with crude oil production.

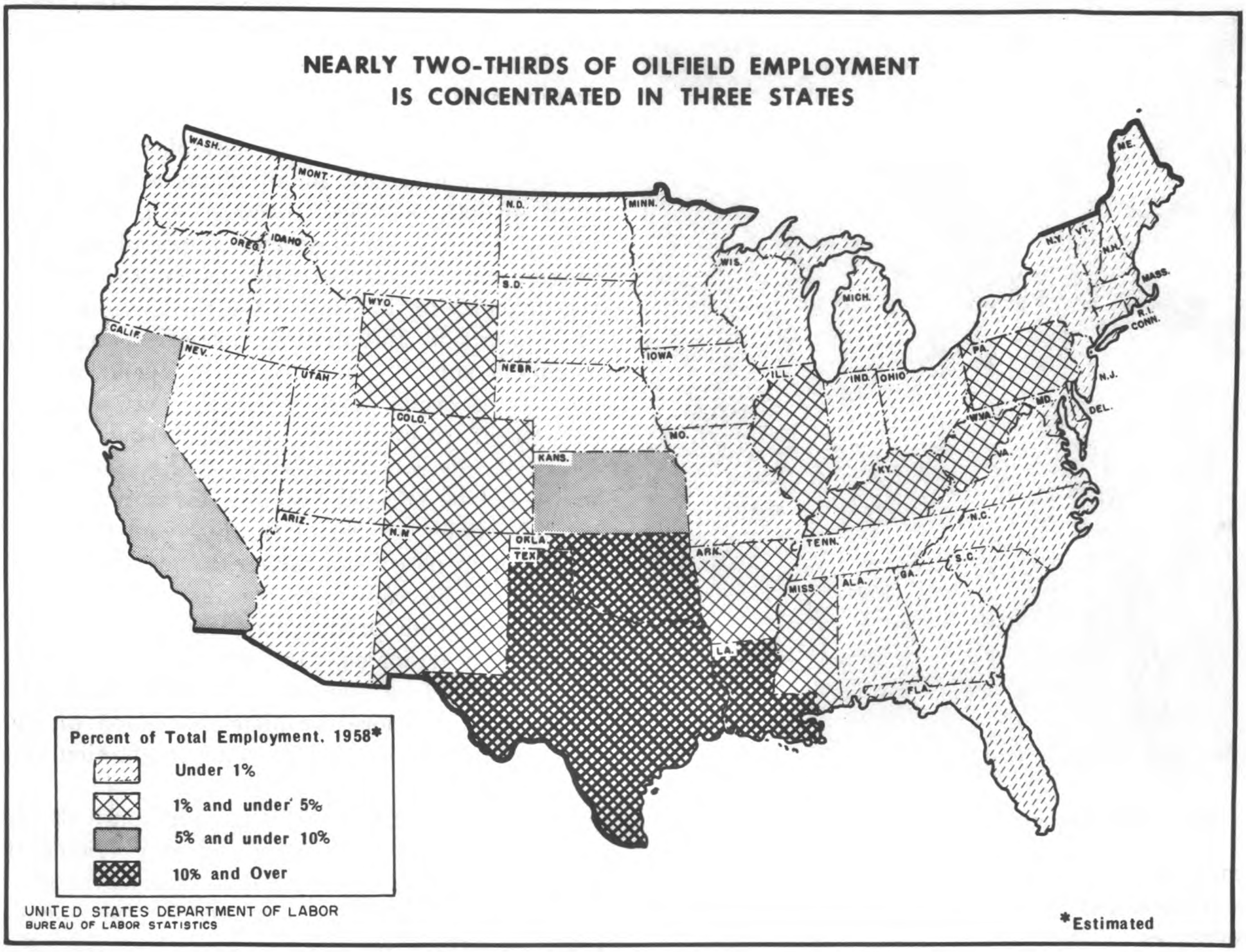
Petroleum Production. In 1958, more than 300,000 wage and salary workers were employed in petroleum and natural gas production in the United States. Although drilling for oil goes on in 42 States, more than 90 percent of the workers were employed in 10 States. (See chart 45.) Texas was the leading State in the number of oilfield jobs, followed by Oklahoma, Louisiana, California, Kansas, Illinois, New Mexico, Wyoming, Colorado and Pennsylvania. About 10,000 Americans were also employed in production and refining jobs in other countries. These jobs were concentrated in the Middle East, particularly in Saudi Arabia. Many Americans also worked for oil companies in Venezuela and other South American countries and in Canada.

Crude oil is the raw material of the petroleum industry. The jobs and processes in the petroleum production branch of the industry deal with the problems of finding crude oil and extracting it from the earth. Petroleum production includes three broad kinds of work: Exploration, drilling, and oilfield servicing; well operation; and maintenance.

Exploration. Since oil is difficult to find—only rarely are there any signs on the earth's surface of its presence underground—a sizable business has grown up having to do with the application of scientific methods to the search for oil. This work is performed by the exploration departments of major oil companies. Some independent firms also specialize in exploration, working under contract to companies or individuals seeking appropriate places to drill for oil. Approximately 15 percent of all petroleum production workers are engaged in exploration.

The various exploration methods can show neither the precise location of oil nor indicate with certainty whether petroleum is present at a particular place. What they can do is to locate geological formations and conditions favorable to oil accumulation. When oil is believed to be located beneath the surface of the earth, the drilling process begins.

CHART 45

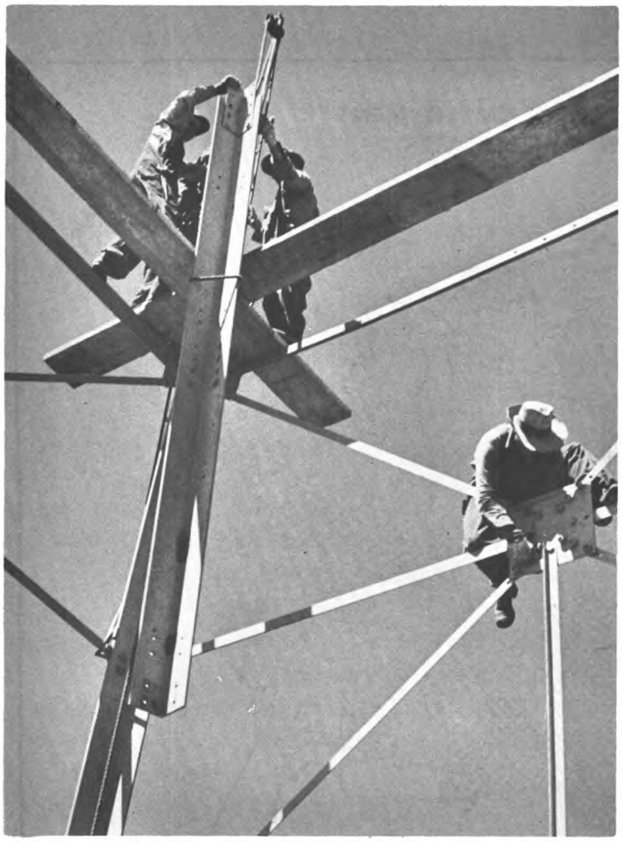


Drilling, rig building, and other oilfield servicing. Nearly 50,000 wells were drilled in the United States in 1958, representing a total footage of almost 200 million feet. Approximately 35 percent of the petroleum production employees were in this type of work. In 1958, Texas was the leading State both in number of new wells and in total footage drilled, followed by Oklahoma, Kansas, Louisiana, Illinois, Kentucky, New Mexico, and California.

Large oil-producing companies do some of their own drilling, but more than 95 percent of this work is contracted out to independent firms. These firms specialize in building, repairing, and dismantling rigs and derricks. Before a well can be drilled, a towerlike structure (derrick) is built on the location selected by the exploration party as most likely to contain oil. This derrick is the framework that supports the machinery and drilling equipment.

Besides rig building and drilling, a number of other necessary services are performed in connection with oil production. These services include hauling supplies, cementing wells, cleaning wells with chemicals, and other special operations. Most of this work is handled by independent contractors. When oil is reached, the job of the drilling crew is finished and the well-operating crew takes over.

Well operation and maintenance. More than half of the petroleum production workers operate or maintain nearly 575,000 oil-producing wells in the United States. Oil wells are operated by thousands of companies, ranging in size from some of the largest concerns in the world to small firms with only a single well. After



Rig builders erect and dismantle the giant steel derricks.

crude petroleum is brought out of the ground, it is transported by pipelines, ships, and trucks to refineries.

Petroleum Refining. Crude oil as it comes from the ground has few uses. It must be taken apart and built up or broken down by heat, chemicals, and pressures to make useful end products, such as gasoline, fuel oil, kerosene, and lubricants. This processing is called refining and is done in plants called refineries.

More than 300 refineries were in operation in the country in 1958, employing almost 200,000 wage and salary workers. Refineries range in size from small plants with fewer than 50 employees to plants with several thousand employees. They are usually located in the great oil-consuming or oil-producing areas—near oilfields, at terminals of oil pipelines, or at deepwater ports where tankers can dock. Refineries are located in 40 States, but nearly 80 percent of the refinery workers are employed in only 8 of them: Texas, California, Pennsylvania, Louisiana, Indiana, New Jersey, Illinois, New York, Oklahoma, and Ohio. (See chart 46.)

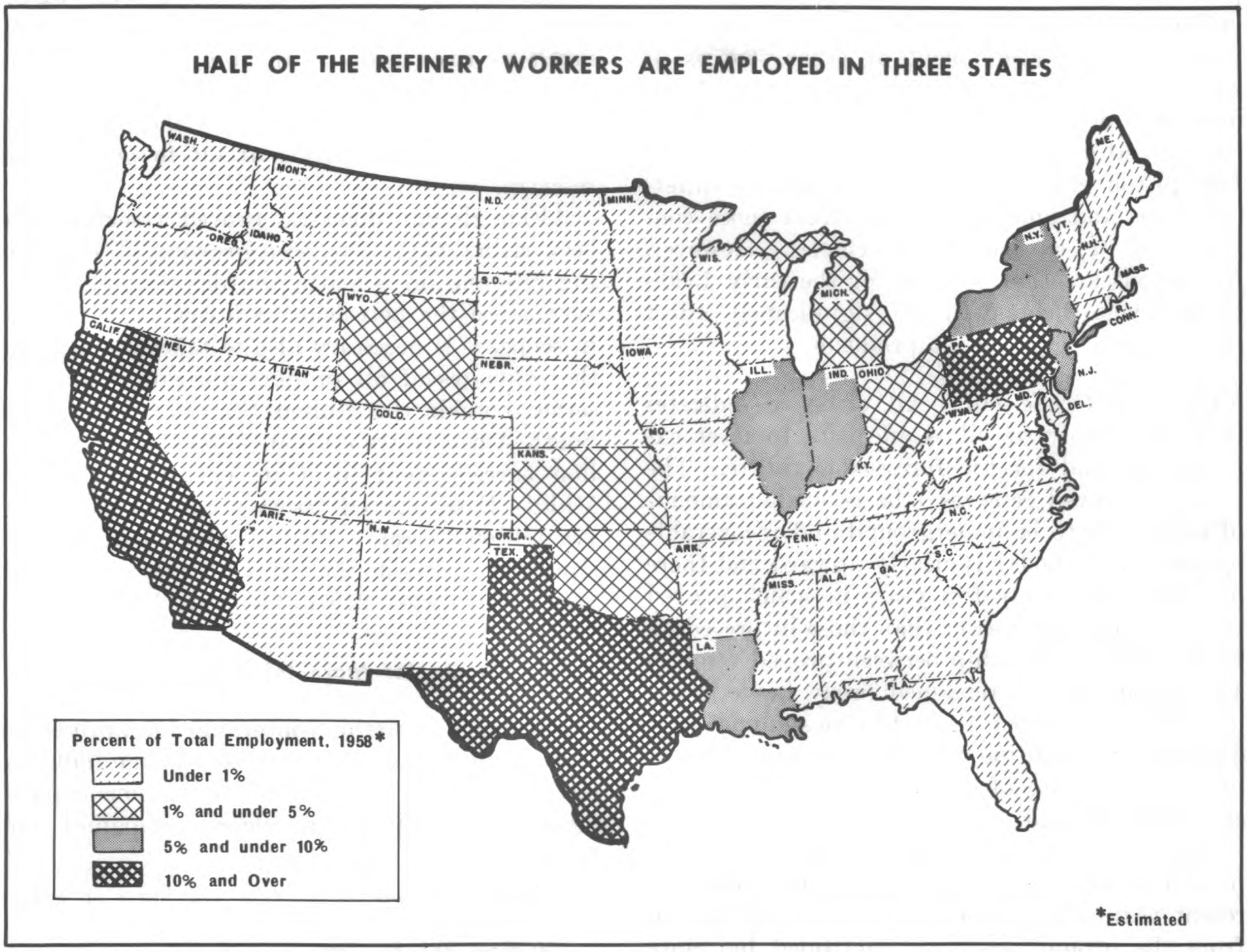
Employment Outlook

The growing demand for petroleum products is expected to result in an increase in employment in both petroleum production and refining in the 1960's. Employment in petroleum production may be affected, however, by the increasing difficulty of finding oil and the increased cost of exploration and drilling activities. If these factors result in an increased dependence on imports of crude petroleum, they may slow the growth of employment in this branch of the industry. Petroleum refining, on the other hand, would not be affected by crude oil imports since the oil would be refined in this country. Employment in petroleum refineries, however, is not expected to increase nearly as fast as the rate at which petroleum products are consumed. Technological developments in refining processes are increasing output per worker. (See pages 640 and 644 for a more complete discussion of the employment outlook in petroleum production and refining.)

Many factors affect the long-range outlook for employment in the petroleum industry. Some of them are reasonably predictable, such as the generally rising trend in demand for petroleum products, others are more or less uncertain. No one knows, for example, exactly how much oil remains underground, where it is, or how long it will be before it is discovered. Another imponderable, in the long run, is the rate at which alternate sources of energy may be developed. The future of oil is uncertain in another respect. The petroleum industry is worldwide and its products not only are essential in the normal operation of our industrial society, but also have critical military importance. Unpredictable military and diplomatic factors, therefore, may greatly affect the demand for petroleum products. Nevertheless, observable trends can be used in evaluating future job opportunities, subject to the qualifications noted.

Demand for Petroleum Products. The long-range trend in demand for petroleum products has been sharply upward. Many factors have

CHART 46



contributed to this growth. Probably the most important single element has been the rapid increase in the number of motor vehicles. In 1900, for example, only about 8,000 automobiles were registered in the United States; by the end of 1958, about 68 million cars, trucks, and buses were in use. The growth of other forms of transportation, such as airplanes and diesel locomotives, has increased the demand for petroleum products. There has also been a steady rise in the amount of fuel-consuming mechanized equipment used for farms, mines, and construction. Several million homes, offices, and factories are now being heated by oil. The petroleum industry supplies a large portion of the fuel used to generate power. Petroleum has also become an important source of raw materials in the manufacture of chemical products. In fact, chemicals with a petroleum base made up over half of the value of all chemicals produced in 1958.

All indications point to a continued and fairly rapid rise in demand for petroleum products during the 1960's. Most of the factors responsible for past growth are expected to continue to influence further growth. Although the general trend will be upward, individual products within the industry will show different growth patterns. For example, sales of kerosene have declined as modern methods of heating and cooking were introduced. However, the recent development of jet planes, which use a kerosene mixture as a fuel, may increase the demand for this type of fuel.

It is also necessary to consider possible competitive sources of energy and technological developments which may affect the demand for petroleum products. These include the commercial production of liquid fuels from oil shale and coal, and the development of other sources of energy such as solar or atomic energy. A development which may affect oil consumption is the commercial application of the gas turbine or the free piston engine which would require different types and amounts of fuel from those consumed by present-day motor vehicles. However, indications are that at least for the early 1960's these developments will not significantly affect the demand for petroleum products.

Supply of Crude Oil. All evidence indicates that the supply of oil is adequate to meet expected demand for the foreseeable future. The trend in proved reserves (the estimated amount of oil known to be underground and recoverable by present methods) is clearly upward and there have been relatively few years in which proved reserves were not greater than those in preceding years. The relationship between proved reserves and production has remained fairly stable in the past 30 years—about 12 or 13 times annual production. In addition to proved reserves, many billions of barrels of oil are believed to be present under ground.

Our oil supplies are being stretched by improved recovery and conservation methods. In recent years, the rate at which oil is withdrawn from the ground has been controlled by State action or by voluntary agreements of petroleum producers, thereby increasing the amount of oil recoverable from each pool. Where formerly as much as two-thirds of the oil was left in the ground, new methods have been developed to recover as much as 80 percent of the oil, adding many millions of barrels of oil to our proved reserves.

Although our domestic proved reserves have been rising, they have been growing at a declining rate and oil is getting harder to find. However, since the petroleum industry is worldwide in scope, it is necessary also to take into account the estimates of oil supplies abroad. Crude reserves outside the United States in North and South America are estimated to be about 25 billion barrels, most of it in Venezuela. In the Middle East, proved reserves amount to nearly 175 billion barrels. Proved reserves of the entire world (outside the United States) were estimated to be over 240 billion barrels in 1958.

Where To Go for More Information

Further information concerning jobs, processes, and working conditions in the petroleum industry can be obtained from the public relations departments of individual petroleum companies and from:

American Petroleum Institute, Committee on Public Affairs,
50 West 50th St., New York 20, N.Y.

Petroleum Production Occupations

Nature of Work

Petroleum production includes three broad kinds of work: Exploration, drilling, and well operation and maintenance. Workers with many different skills are required in petroleum production. Engineers and scientists play an important part in exploration and developmental work. This activity also provides many job opportunities for skilled workers.

Exploration. Exploring for oil is the first step in petroleum production. Small specialized crews travel to remote areas to locate the types of underground geological structures that are likely to contain oil. Exploration parties led by a *petroleum geologist* (D.O.T. 0–35.63) study the surface and subsurface composition of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock and rock formations on and under the earth's surface. Besides making detailed, foot-by-foot surveys, petroleum geologists depend on aerial photographs for a broad picture of the surface features of the area being explored. Geologists often use the "atomic clock," a device that determines the absolute age of rocks by measuring their radioactivity. Subsurface evidence is collected by making test drills and bringing up samples of the rocks, clays, and sands that form the layers of the earth. Research geologists study and analyze these samples to find any clue that might indicate the presence of oil. From these examinations, geologists can draw a cross-section map of the subsurface area being surveyed in order to pinpoint areas where oil may be located.

The main function of petroleum geologists is to recommend where to drill for oil. They also advise management on methods of drilling and oilfield development. They may make appraisals of properties for leasing and estimate oil reserves. Many geologists work in the central district office of oil companies or exploration firms where they interpret data collected by exploration parties. Some of them, however, spend a great deal of their time making field surveys in rough and isolated sections of the country.

Geological parties may include, in addition to the geologist, *paleontologists* (D.O.T. 0–36.03), who study the fossile remains in the earth in order to locate oil-bearing sands; *chemists* (D.O.T. 0–07.03) and *mineralogists* (D.O.T. 0–35.63), who study physical and chemical properties of minerals and rock samples. *Plane-table operators* (D.O.T. 0–64.30), *draftsmen* (D.O.T. 0–48.50), and *rodmen* (D.O.T. 7–87.100) assist in surveying and mapping operations. A shallow drilling crew may also be part of the party.

Another method of searching for underground pools of oil is through geophysics—which is the study of the inner characteristics of the earth's structure. Nearly 90 percent of geophysical exploration is done by seismic prospecting. The seismograph is a precision instrument which records natural and manmade earthquakes. Manmade earthquakes are caused by exploding small charges of dynamite in the ground. The rate of transmission of sound waves through the earth is then measured, recorded, and interpreted by a geophysicist to determine deep underground formations which may indicate an oil pool.

A seismograph crew generally consists of from 10 to 18 persons working under the supervision of a party chief, who is usually a college-trained *geophysicist* (D.O.T. 0–35.65). Duties of geophysicists are similar to those of geologists. In addition to recommending where to drill for oil, they may also be assigned to supervise petroleum production operations. A seismograph crew includes other workers. For example, *computers* (D.O.T. 0–66.67) prepare maps from the seismic data. *Observers* (D.O.T. 0–66.66), who are often electrical engineers, operate and maintain the seismic equipment. *Prospecting drillers* (D.O.T. 5–75.050) and their *helpers* (D.O.T. 7–75.050) operate portable drilling rigs to make holes into which explosive charges are placed. *Shooters* (D.O.T. 5–74.030) are in charge of placing and detonating explosive charges.

Gravity prospecting, another method of finding oil traps, makes use of the gravity meter. This instrument is an extremely sensitive scale that accurately measures changes in the pull of gravity. The gravity meter, by detecting variations in gravity pull, helps disclose the possible presence of oil-bearing structures. Workers employed in gravity prospecting include operators of gravity measuring instruments, draftsmen, computers, party chiefs, and surveying crews.

Another method of exploring underground areas is by electricity. A special electric probe is lowered into a well. A current is passed through the layers of rock, sand, and clay and their resistance to the current is measured. Different kinds of rock have varying resistance to electricity. Resistance is affected also by the oil, gas, or water content of rocks. An electrical prospecting party usually has from 4 to 8 members, including the party chief, surveyor, operators of electrical measuring instruments, and *cablemen* (D.O.T. 7–20.930).

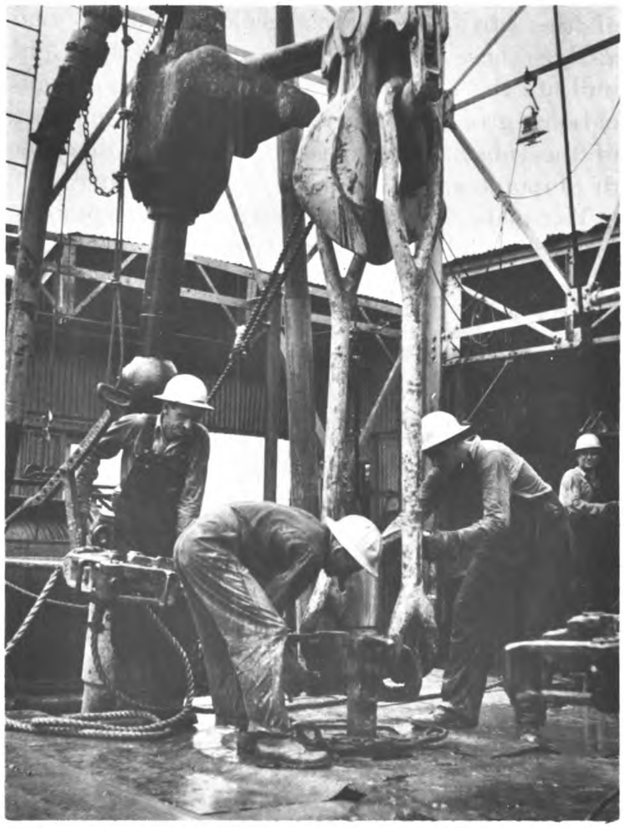
The *landman* or *leaseman* (D.O.T. 0–98.22 and 1–48.21) has important duties in exploration and oilfield development. His job is to make necessary legal and financial arrangements with owners of prospective oil land in which his company is interested. Another important job in oil exploration is that of the *scout* (D.O.T. 1–48.22). He keeps his company informed on all exploring, leasing, drilling, and production activity in his area.

(Discussions of some of these professional occupations are included elsewhere in this Handbook. See index for page numbers.)

Drilling. Despite all the exploration methods that have been developed, no device that will actually find petroleum has been discovered. Only by drilling can the presence of oil be proved. There are two methods of drilling a well—rotary drilling and cable-tool drilling. No matter which method is used, all wells are started in the same way. First, a pit is dug for machinery and pipe connections. Rig builders and a crew of helpers erect a steel tower, called a derrick. The main purpose of the derrick is to support the machinery and equipment which raise and lower the drilling tools. Overall planning and supervision of drilling are usually the responsibilities of the *petroleum engineer* (D.O.T. 0–20.11). He helps to select drilling sites and the method of drilling. He directs rig builders and other workers in erecting the derrick and installing the drilling machinery. He advises drilling personnel on technical matters and may supervise the completion of wells.

The rotary method is used for drilling deep wells in locations where the formations are soft and caving such as those found in Texas and Oklahoma. In 1958, about 85 percent of the wells in the United States were drilled by this method. Rotary drilling bores a hole in the ground in much the same way that a carpenter bores a hole with a brace and bit into a board. The drilling bit is a steel tool with cutting teeth at its lower end. The bit is attached to a string of jointed hollow pipe which is rotated by a steam, diesel, or gasoline engine. As the bit goes down, the drill stem is lengthened by the addition of more pipe which is screwed on at the upper end. A stream of mud is continuously pumped through the hollow pipe. This mixture of clay and water cools the drill bit, plasters the walls of the hole to prevent cave-ins, and brings cuttings to the surface.

A typical rotary drilling crew consists of a rotary driller and four or five helpers. From 15 to 20 workers, divided into 3 crews, generally are required to operate a rig 24 hours a day, 7 days a week. The *rotary driller* (D.O.T. 5–75.-050) is in charge of the work of the crew during his tour of duty. His major duties include operating the drilling machinery, controlling drilling speed and pressure, and keeping a record of operations. He must be ready to meet a variety of emergencies, such as the breakdown of equipment or occurrence of unusual geological formations. His helpers include a *derrickman* (D.O.T. 5–20.-825), a *rotary fireman* (D.O.T. 7–70.070) (if steam is used) or *engineman* (D.O.T. 5–72.915) (if diesel or electric power is used), and one or two *rotary floormen* (D.O.T. 7–75.050). The derrickman is second in charge on the drilling rig. When pipe is being removed or attached, the derrickman handles the upper end of the pipe, working on a small platform high on the rig. Rotary floormen guide the lower end to and from the well opening, and connect and disconnect the pipe joints. The derrickman also controls the consistency and circulation of the drilling mud. The fireman or engineman operates the engine which provides power for drilling.



Rotary crew on derrick floor preparing to run drill pipe into the well.

Another important oilfield worker is the *tool pusher* (D.O.T. 5–93.310) who supervises the operations of a group of either cable- or rotary-drilling rigs. He also is in charge of supplying the drilling crews with needed materials and equipment. *Roustabouts* (D.O.T. 9–20.10) or general oilfield laborers, are not part of drilling crews but are utilized to do odd jobs.

Cable-tool drilling was the original method of drilling wells, but it has been replaced to a great extent by rotary drilling. In cable-tool drilling, a hole is broken through rocks by continuously raising and dropping a heavy, sharpened bit attached to the end of a cable. At present, this method is mainly used to drill shallow wells in hard rock formation. Most of it is done in Kentucky, Ohio, West Virginia, Pennsylvania, and the rocky areas of Texas and Oklahoma.

A cable-tool drilling crew usually consists of the driller and the tool dresser. The *cable-tool driller* (D.O.T. 5-75.270) is in charge of all operations during his tour of duty and maintains a detailed record of drilling activity. One of his functions is to control the force with which the drilling bit strikes the rocks at the bottom of the well. He also supervises and helps in setting up the machinery and derrick. The *cable-tool dresser* (D.O.T. 5-75.280) assists the driller and maintains the equipment.

Well Operation and Maintenance. Production begins when oil is struck. The drill is pulled from the well and the work of lowering the casing or tubing begins. The upper end of the tubing is connected to a valve and pipeline system. Gas pressure in the well forces the crude oil to the surface and the well begins to flow. If there is not enough natural pressure to force the oil to the top, the well is equipped with a pump. In 1958, nearly 90 percent of the wells in operation were equipped with pumps to produce an artificial flow of oil.

Many kinds of workers are employed in a producing field. Petroleum engineers are generally in charge of overall planning and supervision of production operations. One of their principal functions is to prevent waste by determining oil flow rates and production methods. Some companies hire assistants to the petroleum engineer. These aids perform routine duties such as making elementary calculations, running tests, and keeping records. The job of pumper is the largest occupation in the oilfield. *Pumpers* (D.O.T. 5-72.570) and their *helpers* (D.O.T. 7-72.570) operate and maintain power units, pumps, and other equipment used to force an artificial flow of oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer. Generally, a pumper operates a group of wells. *Switchers* (D.O.T. 5-20.600 through .699 and 7-20.610) work in fields where oil flows under natural gas pressures and does not require pumping. They open and close valves to regulate the flow of oil from wells to tanks, between tanks, or directly into pipelines. *Gagers* (D.O.T. 6-55.060) keep track of the amount of oil flowing into the tanks or pipelines. They measure and record the contents of storage tanks and take samples of the oil to check its quality. *Treaters* (D.O.T. 7-20.410) test oil from wells for water content and the sediment which settles to the bottom of the storage tank. These impurities may be drained away by a tap at the base of the tank. Sediment may also be removed by chemical or electrical equipment. In many fields, one man may perform any combination of the jobs of pumping, switching, gaging, or treating. Roustabouts perform the various field and well maintenance jobs which require relatively little skill, but often involve heavy, hazardous work.

A number of workers are engaged in various specialized maintenance operations in oilfields. Welders, carpenters, electricians, machinists, and blacksmiths are employed to repair and install equipment. (Discussions of these and other maintenance occupations are included elsewhere in this Handbook. See index for page numbers.)

Other Oilfield Services. Companies engaged in oilfield contract services (other than exploration and drilling) on a fee basis provide another important source of employment. They perform many services including cementing and cleaning wells and running, cutting, and pulling casing tubes and rods. These contractors employ such skilled workers as *cementers* (D.O.T. 5-20.020) who mix and pump cement into oil well holes to seal space between steel casings and side walls to provide protection and control for underground operations; *acidizers* (D.O.T. 5-20.420) who force acid into formations of rock or earth to make the oil flow faster; *perforator operators* (D.O.T. 5-74.040) who pierce holes at various points in drill pipes or casings with controlled explosives to make passages for oil or other fluids used in drilling processes; *sample-taker operators* (D.O.T. 5-74.042) who obtain samples of earth formation from wells to determine the presence of oil. Also employed are well-pulling crews, who use mechanical winches to remove pipes and casings from wells for cleaning and repairing the equipment or for salvaging when wells are abandoned.

Offshore Operations. Although most exploration, drilling, and producing are done on land, an increasing amount of these operations is being performed offshore, particularly in the Gulf of Mexico off Louisiana and Texas. Some wells have been drilled as far as 100 miles from shore in water up to 200 feet deep. In addition to the same types of workers employed in land operations, radio men, able-bodied seamen, cooks, and mess boys are employed.

Training, Other Qualifications, and Advancement

Exploration. Nonprofessional workers of an exploration crew generally start as helpers and work into one of the specialized jobs after they have acquired experience. Their period of training on the job may vary from several months to several years. New workers are usually hired in the field by the party chief or by local company representatives. Companies generally hire young men with a high school education or its equivalent and with training or aptitude in mathematics, drafting, and mechanics for many of their nonprofessional jobs. College students majoring in the sciences are often hired for part-time or summer work for these jobs. This may be a means of working into a full-time job after graduation.

College training with at least a bachelor's degree is generally required for entry into professional occupations such as geologist, geophysicist, chemist, or engineer. Professional workers usually start at junior levels and, after one or more years of experience in field surveys, are eligible for promotion to party chiefs. After this experience, they may advance to a position of responsibility in an area or division office and then perhaps to the central office. Persons with research ability may move to research or consulting work.

Drilling. Drilling crew members generally are hired as roustabouts or as rotary floormen. As they acquire experience and know-how, they may advance to more skilled jobs. In rotary drilling, for example, a worker may be hired as a floorman and eventually advance to derrickman. After several years, he may attain the status of driller. Drillers can be promoted to the job of tool-pusher in charge of several drilling crews.

The work of roustabouts, rotary floormen, and derrickmen requires men capable of performing heavy physical labor. Drilling crew members are usually between the ages of 20 and 40. Some companies, however, report that their best drillers are over 50 and even in their 60's, for the job of driller requires good judgment and practical experience rather than strength or agility.

Well Operation and Maintenance. Companies generally hire persons living in the vicinity for well operation and maintenance jobs. They prefer men with mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs.

New workers may start as roustabouts and advance to jobs as switchers, gagers, or pumper helpers, and later to pumpers. Training is usually acquired on the job and at least 2 years of experience is necessary to become a good all-round pumper.

The preferred educational qualification for a petroleum engineer is a college degree with specialization in courses dealing with the petroleum industry. However, college graduates with degrees in chemical, mining, or mechanical engineering, or in geology or other related sciences are sometimes hired for petroleum engineering jobs. Petroleum engineering aids generally are former roustabouts or pumpers. They are given several months of on-the-job and classroom training.

Employment Outlook

Employment in crude petroleum production should expand steadily during the 1960's. Replacement needs will also create job openings for new workers.

Employment in the production of crude petroleum has been rising for many years. A particularly rapid growth of employment occurred in the post-World War II period. From 1946 to 1958, employment increased nearly 40 percent from 220,000 to 302,000. Employment is expected to continue to increase steadily in the 1960–70 decade, but at a slower rate than during the postwar years. However, this rate of increase should be faster than the growth of the Nation's total labor force, which is expected to increase by almost 20 percent in the 1960–70 decade.

Although the demand for crude petroleum is expected to double during the next two decades, domestic crude production may increase at a somewhat slower rate. Increasing costs of new petroleum discoveries and higher costs for developing domestic oilfields may possibly result in a greater proportion of our requirements for crude petroleum being supplied by imports. The amount of imported crude oil increased from 8 percent of consumption in 1952 to over 15 percent in 1958.

Because of the difficulties related to finding oil and bringing it to the surface, there may be differences in the rates of growth of employment in the three segments of crude petroleum production—exploration, drilling, and well operation and maintenance. Their respective employment outlooks are discussed briefly below.

The number of workers employed in exploration activities is expected to increase moderately during the 1960's. As oil pools and reserves become depleted, exploration geologists and geophysicists will be needed to find new drilling sites at greater depths underground and underwater. More geologists and geophysicists will be required in laboratories to develop new exploration techniques and instruments and to analyze core samples and seismic readings. It is also expected that employment opportunities will increase abroad for American geologists as major oil companies expand exploration activities in foreign lands.

The increased demand for petroleum products should also result in greater drilling activity. The number of new wells and the total footage drilled has grown rapidly since World War II. There has been a trend toward digging deeper into the ground to find oil pools. The average well is over 4,000 feet deep and there are some wells with a depth of more than 4 miles. As new techniques develop, such as jet drilling or turbodrilling, wells can be drilled at even lower depths. During the 1960–70 decade, drilling employment will probably continue to increase, but at a slower rate than in the past 10 years. Additional petroleum engineers and drilling crews will be needed during this period as well as oilfield servicing specialists, such as cementers and acidizers.

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The greatest increase in employment in crude petroleum production is expected in well operation and maintenance—the largest segment of this branch of the industry. At the end of 1958, there were nearly 575,000 producing wells, 36 percent more than 12 years earlier. During the 1960–70 decade, the increasing number of producing wells is expected to result in a relatively large growth in well operation and maintenance employment. More pumpers and skilled maintenance workers will be needed to operate these wells and to keep the equipment in good running order.

Besides job opportunities in petroleum production arising from the growth of this branch of the industry, replacement needs resulting from retirements, deaths, and transfers to other fields of work will also provide many openings for new workers. Retirements and deaths alone will probably result in about 5,000 to 7,000 job openings annually during the 1960–70 decade.

Future job opportunities should continue to be concentrated in the States with the largest number of producing wells and the highest reserves—Texas, Oklahoma, Pennsylvania, Kansas, Illinois, California, and Louisiana. Although offshore activities in 1958 accounted for only a small portion of total production employment, they are expected to increase greatly in the 1960's, particularly off Texas and Louisiana.

Earnings and Working Conditions

Earnings of oilfield workers are among the highest in American industry. In April 1959, earnings of nonsupervisory employees in petroleum and natural gas production (excluding contract services) averaged \$112.59 a week or \$2.78 an hour, compared with an average of \$89.87 a week or \$2.23 an hour for production workers in all manufacturing industries.

Data on recent earnings for individual occupations are not available. However, an examination of a number of 1957–58 union agreements, which cover only a small part of employment in petroleum production, indicates the following range of earnings in selected occupations: Among drilling employees, rotary drillers generally were earning from $3.25 to $4.05 an hour, derrickmen from $2.60 to $2.75, and rotary floormen from $2.45 to $2.65.

The average starting salary for geologists with a bachelor's degree and no experience was about $440 a month in the petroleum industry, according to the American Geological Institute. Graduates with a master's degree started at about $507 a month and those with a doctor's degree at about $641. Graduates with job-related experience and special skills were paid above-average entrance salaries. Salaries for foreign assignments ranged from 15 to 25 percent extra.

Most oilfield work is done outdoors and thus the workers are exposed to extremes in weather. Fields may be near cities; however, they are more often far from sizable communities and are sometimes located in swamps or deserts. Drilling employees may expect to remain in one place a few years at most. Generally, their work in a particular field may be completed in less than a year. Exploration personnel move even more frequently. Workers in well operation and maintenance often remain in the same location for long periods.

Exploration work is generally performed during daylight hours and crews often work more than 40 hours a week. Drilling is done around the clock and each well has a complete crew for each 8-hour shift. Work on the various shifts is usually alternated. Employees in well operation and maintenance usually work a basic 40-hour week.

In offshore operations, basic wage rates are the same as those in land operations. Except for drilling activity that is close to shore, workers' living quarters are on platforms held fast to the ocean bottom or on ships anchored near this activity. Living quarters, as well as meals, are provided by the employer generally without charge. Tours of duty vary from 3 to 12 or more consecutive days, depending upon company policy and distance from shore, with an equal number of days off on land.

Accident data indicate that occupations in exploration and crude production are not particularly dangerous. They have a lower accident frequency rate, for example, than the average for all manufacturing industry. Drilling, on the other hand, is much more hazardous. However, during recent years, improved equipment and drilling methods and special safety training have greatly reduced hazards.

Most oilfield workers are not union members. Some fields, however, have been organized by the Oil, Chemical and Atomic Workers International Union. The International Union of Operating Engineers and some independent unions have also organized oilfield workers.

Petroleum Refining Occupations

Nature of Work

Crude oil, as it comes from the ground, has very few uses; it must first go through an elaborate manufacturing process called refining. Petroleum refining changes crude oil into gasoline, kerosene, fuel oil, lubricants, and other products for use in homes and industry. The modern refinery is a complicated structure made up of a maze of pipes, tanks, and towers. From the time crude oil enters the refinery to the shipment of finished products, the flow of production is continuous. The refining process is highly automatic and is controlled by instruments which measure and regulate the flow, temperature, and pressure of the liquids and gases going through the pipes and tanks.

In its simplest form, petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The vapors from the heated oil pass into a tower where the various fractions or parts of crude oil are condensed. The resulting liquids are drawn off through pipes at different temperatures in the tower. Many refineries have large "cracking" units to obtain more gasoline per barrel of crude oil. Cracking is a process which breaks down, or rearranges, large molecules into smaller ones by means of either great heat and pressure or heat and the action of a catalyst.

About a third of the plant workers in refineries in 1958 were employed in processing work. A key job in converting crude oil into usable products is held by the *stillman* (D.O.T. 4–55.030)

Stillman reading instruments on graphic panel which shows flow plan of entire refinery.

or operator. He is responsible for the efficient operation of one or more processing units. The stillman observes and records instrument readings of temperature, pressure, and oil flow. To simplify supervision of these instruments, some modern refineries use graphic panels which display instruments on a flow plan so that the stillman can easily see the entire operation of the refinery. He also makes necessary adjustments so that oil products will meet specifications. One of the duties of the stillman is to patrol all the equipment to check its operating condition. A stillman has one or more *assistants* (D.O.T. 6–55.020) depending on the number and size of the units he operates.

In addition to the stillman and his assistants, there are other plant workers whose jobs are related to the processing of crude oil. These workers are usually designated according to the type of equipment they operate. For example, *pumpmen* (D.O.T. 5–72.550) and their *helpers* (D.O.T. 6–55.930) maintain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing. *Treaters* (D.O.T. 4–55.310) run purification units to remove impurities that are present in gasoline, oil, and other petroleum products.

Because the complicated equipment in petroleum refining is subject to high heat and pressure which wears down this equipment, the industry employs a large number of maintenance workers. More than half of the plant workers in a typical refinery repair, rebuild, and clean the highly complicated machinery and equipment. Included among these are skilled boilermakers, carpenters, electricians, instrument repairmen, lead burners, machinists, masons, painters, pipefitters, pipe coverers, riggers, sheet-metal workers, and welders. There are also many helpers and trainees in these trades. (A detailed discussion of the duties, training, and employment opportunities in many of these maintenance jobs appears elsewhere in this Handbook. See index for page numbers.)

Other plant workers, who do not operate or maintain equipment, do a variety of other tasks in refineries. Some workers are employed in the packaging and shipping department; some load and unload materials on trucks, trains, or ships; some workers drive trucks and tractors to deliver materials to various parts of the plant; and others keep inventory records of stock and tools. The industry also employs custodial workers, such as guards, watchmen, and janitors.

The petroleum refining industry employs many persons with chemical, engineering, and other scientific backgrounds. A large proportion of these technical workers are employed in the industry's research activities. Researchers try to find better ways to explore for oil, to recover it, to break it up into useful products, to discover new products, and to improve those already produced. Some of these scientific and technical employees are in separate laboratories in communities other than those in which the refineries are located. Among the technical workers employed in refineries are chemists, chemical engineers, mechanical engineers, petroleum engineers, laboratory technicians, and draftsmen.

Chemists control the quality of petroleum products by conducting tests and analyses to determine chemical and physical properties. Many chemists are engaged in research and development of new products and processes. Some laboratory technicians assist chemists in research projects; others do routine testing and sample taking.

Engineers are employed in a variety of refinery activities, including design of chemical equipment and plant layout; and supervision and development of processes and quality control. Draftsmen prepare working plans and detailed drawings required in refinery construction and maintenance. (Detailed descriptions for many of these scientific and technical jobs are found elsewhere in this Handbook. See index for page numbers.)

A wide variety of administrative, clerical, and other white-collar personnel are employed by refining companies. A large number of the higher level administrative and management positions are filled by technically trained men, many of whom are engineers. Other specialized workers in the field of administration include accountants, purchasing agents, sales engineers, and lawyers. Many typists, stenographers, secretaries, bookkeepers, and business machine operators are required to assist these specialized workers.

Training, Other Qualifications, and Advancement

The petroleum refining industry generally hires inexperienced workers for its processing jobs and trains them on the job. A new worker usually starts out in a labor pool where he does such jobs as moving materials, packing cartons, or filling barrels. After working in the labor pool for a few months, he may be transferred to one of the processing departments when a vacancy occurs. Here he learns more skilled work on the job under the supervision of experienced workers. As he gains experience and know-how, he moves to the more skilled jobs in his department. For example, one possible line of promotion for a processing worker may be from laborer, helper, assistant stillman, to stillman. Skilled processing workers are rarely recruited from other plants.

Pipefitters installing a control valve in a refinery.

Most maintenance jobs are filled by men who are trained on the job in the refinery. However, a qualified journeyman may be hired directly into one of the craft jobs when no trainees are qualified and available for promotion. Many refineries have training programs to meet the needs of their maintenance shops. These programs include on-the-job training with some classroom instruction related to the trainee's particular work. A new worker may be transferred from the labor pool to helper or learner in one of the trades. Over a period of 3 or 4 years, he is trained to become skilled in such work as boilermaking, pipefitting, or welding. Some refineries have formal apprenticeship programs to train workers for skilled maintenance occupations.

Companies in the industry often require their new plant workers to have a high school education. Psychological testing and interviewing are used in selecting employees in large refineries. Qualifications for scientific, administrative, and clerical jobs are similar in the refining industry to those in other industries. A bachelor of science or a bachelor of engineering degree is usually the minimum educational requirement for scientists and engineers. For research jobs, persons with advanced degrees are preferred. Laboratory assistants begin their work in routine jobs and advance to positions of greater responsibility after they have acquired additional experience and demonstrated their ability to work without close supervision. Inexperienced draftsmen usually begin as copyists or tracers. With additional experience and training, they may advance to more skilled and responsible drafting positions. Administrative positions are frequently filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. Most refineries employ persons who have had commercial courses in high school or business school for positions as clerks, bookkeepers, stenographers, and typists.

Employment Outlook

Petroleum refineries are expected to provide thousands of job opportunities for new workers in the 1960's. Many of these openings will result from the anticipated expansion of the petroleum refining industry. The rate of increase will probably be somewhat less than the growth of the Nation's total labor force which is expected to increase by almost 20 percent during the 1960's. Job openings will also result from the need to replace workers who leave the industry.

Increased refinery output will be necessary to supply petroleum products needed by a rapidly expanding economy. The growing number of automobiles, airplanes, tractors, home heating units, and industrial users will continue to make strong demands for petroleum products. It has been estimated that the 1975 demand for petroleum products may be double that of 1955. However, employment will grow at a much slower rate than refinery output. This has been the recent trend in petroleum refining. For example, from 1946 to 1958, output increased 60 percent whereas total employment increased only 11 percent. This difference in the rates of growth between employment and production is a result of the industry's emphasis upon improved technology. The trend toward larger and more automatic refineries has also contributed to this difference. A continuation of the relatively rapid rate of technological change and the trend toward larger and fewer refineries is expected in the future.

The emphasis on research and development and the increasing use of instrumentation and automatic equipment will affect differently the rates of growth of individual occupational groups. The number of administrative and technical workers, particularly chemists, chemical engineers, and technicians, is expected to grow faster than the number of plant workers. This will be a continuation of past trends in refineries. In 1958, administrative and technical workers made up more than 35 percent of the industry's total employment compared with 22 percent in 1946. The largest increase in plant worker employment is expected to be among maintenance workers, such as instrument mechanics, pipefitters, machinists, and maintenance electricians.

In addition to openings arising from the anticipated expansion in petroleum refining, the need to replace those workers who retire, die, or transfer out of the industry will provide many job opportunities for new workers. Retirements and deaths alone will result in about 3,500 to 4,500 job openings annually. Most new plant workers will start as laborers since the usual practice in refineries is to fill the more skilled jobs by promotion from within.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in American industry. In April 1959, production workers in petroleum refining averaged $122.29 a week or $2.99 an hour, compared with the average for all manufacturing industries of $89.87 a week or $2.23 an hour. The higher average earnings in refineries reflect the large proportion of workers in skilled occupations.

Information on average earnings in individual occupations is not available. However, an examination of a number of 1958 union agreements in some of the larger refineries indicates the following range of hourly rates in selected plant occupations:

Operating personnel:	
Stillman (chief operator)	$2. 60–$3. 45
Stillman, assistant	2. 35– 2. 90
Pumper, first class	2. 45– 3. 40
Pumper, helper	2. 40– 2. 70
Treater, first class	2. 45– 3. 40
Maintenance personnel:	
Boilermaker	2. 50– 3. 30
Carpenter	2. 50– 3. 30
Electrician	2. 50– 3. 30
Machinist	2. 50– 3. 30
Pipefitter	2. 50– 3. 30
Welder	2. 50– 3. 30
Helpers to above skills	2. 10– 2. 60
Labor pool—starting wage	1. 50– 2. 15

Entry salaries for chemists and chemical engineers in the petroleum refining industry were the highest in American industry, according to a 1958 survey conducted by the American Chemical Society. The survey showed that in this industry the average starting salary for chemists with a bachelor's degree and no experience was $465 a month and for chemical engineers with a bachelor's degree it was $475 a month.

Most petroleum refinery workers are granted vacations with pay after 1 year of service. A large number of the companies have adopted some types of insurance, pension, or medical and surgical plans for their employees. Employee stock-purchase and savings plans, to which the company makes contributions, are in effect in many firms.

Because refining is a continuous, around-the-clock operation, processing workers may be assigned to any one of the three shifts. Generally, workers can expect to be rotated on the three shifts at one time or another and be subject to Sunday and holiday work. Employees usually receive additional pay when they work on the second or third shift. Most maintenance workers are on duty during the day shift; only a few work at night to deal with emergencies. Work in the industry has little seasonal variation and all regular workers have year-round jobs.

Most refinery jobs require little physical effort. However, a few workers have to open and close heavy valves and climb stairs and ladders to considerable heights in the course of their duties. Others may work in hot places or may be exposed to unpleasant odors. Refineries are relatively safe places in which to work. The accident-frequency rate is about half that of manufacturing as a whole.

A majority of refinery plant workers are union members. A large number of refineries have been organized by the Oil, Chemical and Atomic Workers International Union. Some refinery workers are also members of other AFL–CIO unions and various independent unions.

OCCUPATIONS IN PLASTIC PRODUCTS MANUFACTURING

Plastic products are used in thousands of household, industrial, agricultural, and military items and are produced by one of America's faster growing industries. Employment in this industry grew from 18,000 in 1940 to approximately 84,000 in 1958. The value of the industry's products exceeded $1.5 billion in 1957.

Most of the plant jobs require little skill and can be learned in short periods of on-the-job training. The industry, however, employs several thousand tool and die makers, skilled maintenance workers, and a small number of engineers and draftsmen who require years of training, experience, and education for their jobs. About one-third of the workers in this industry are women.

Nature and Location of the Industry

Plastics are synthetic organic materials manufactured from substances such as coal, petroleum, wood, or cotton, which, through the application of pressure or heat, or both, can be formed into almost any desired shape. Although not entirely of recent origin, plastics are primarily the products of modern research.

Plastics are easy to shape by mass production methods and have many other useful properties. Generally, plastic products are light, resistant to chemical corrosion, moisture resistant, easy to color, odorless, and tasteless. Some plastics are noted for toughness and durability, resistance to high temperatures, and electrical insulating qualities, while others are valued for their flexibility and transparency. Because of their varied and unique qualities, plastics have been put to thousands of different uses. Some typical plastic products include radio cabinets, telephone headsets, electrical switch parts, floor tiles, gears, dishes, airplane and missile components, and transparent packaging.

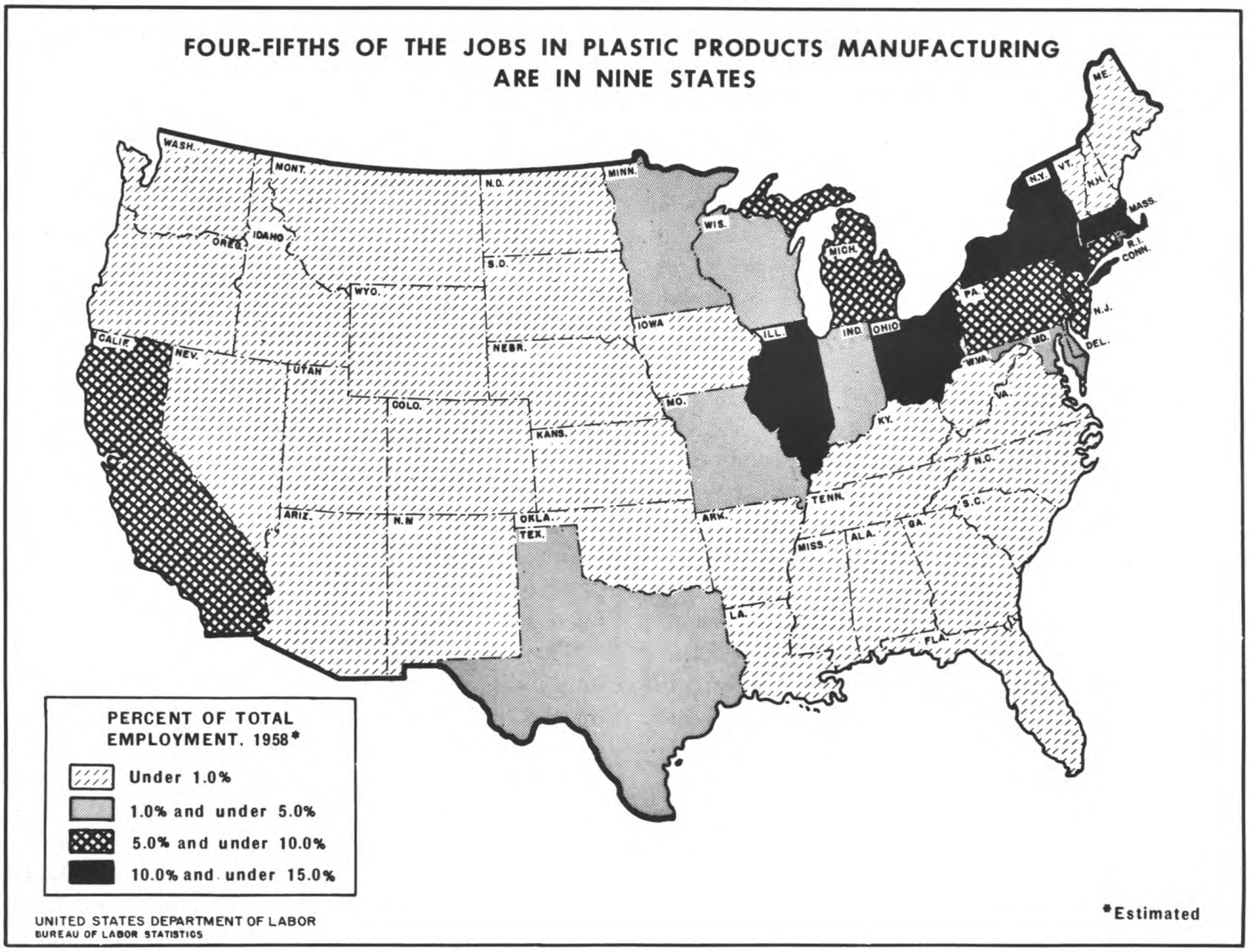
Most of the industry's output consists of plastic parts made to order for other industries manufacturing such items as household appliances, electrical machinery, automobiles, aircraft, or communications equipment. Other plastic products, such as toys, combs, tableware, hose, and pipe, are produced and sold in finished form directly by the plastic products manufacturing industry.

Not treated as part of the industry are the plastic materials producers (part of the chemical industry) who supply molding compounds to molding plants; laminating resins to laminating plants; and plastic sheets, rods, and tubes to fabricating plants. Certain other producers are not considered part of the plastic products industry even though their jobs and production methods correspond. These producers are: (1) The plastics departments of companies such as automobile and electrical machinery manufacturers which make plastic parts for use in their final product and (2) plants producing a particular type of plastic product which is closely identified with another manufacturing industry. For example, plants making plastic buttons are considered part of the button industry.

The more than 2,500 plants in the plastic products industry vary in size from those run by their owners with 1 or 2 helpers to a few large plants with more than 1,000 employees. Most of the plants are small. They are found principally in the more important industrial regions. (See chart 47.) Although these plants were found in 41 States in 1958, about four-fifths of the workers were employed in 9 States: Illinois, New York,

Loading preformed plastic forms into a mold to make washing machine agitators. About one-third of the employees in the plastic products industry are women.

CHART 47



Massachusetts, Ohio, New Jersey, Pennsylvania, California, Connecticut, and Michigan.

Typically, large numbers of each item are manufactured; for example, a plant may have an order for many thousands of identical bottle caps or fountain pen barrels. It is usually not economical to mold plastic products in small quantities, because of the high cost of the individual molds used in their manufacture. Therefore, quantity production in molding is the rule, even in the smaller plants. Without mechanization and quantity production, the cost of such articles would be prohibitive and their widespread use impossible.

Plastic materials are converted to finished products by a number of processes—the most important of which are molding, laminating, and fabricating. In injection and compression molding, the most widely used process, the plastic is made pliable through pressure and heat and pressed by various techniques into a mold where it hardens into the desired shape. In extrusion molding, the plastic in a paste-like form is forced through a die opening. The continuous strip which emerges hardens in the form of the die. Tubes and rods are examples of products formed by extrusion. Laminating is the process used to produce sheets and tubes of high strength and hard finish. Sheets of paper or fabric are soaked in resin solutions and then squeezed together under heat and pressure. Fabricators convert rods, tubes and other plastic shapes into finished products by sawing, machining, or other methods.

Occupations in the Plastic Products Industry

The types of jobs in a particular plant depend upon the plastic products made, the processes used, and the size and organization of the plant. Because most plants restrict themselves to one of the major processes, few plants have all the types of jobs found in this industry. However, the larger plants which use more than one of the different manufacturing processes and may, in addition, have a tool or machine shop and a research department, have a greater variety of jobs. Finishing and inspection jobs as well as office and sales positions are found in almost all plants. Some of the important occupations in this industry are described below.

Molding Occupations. The industry's largest group of workers is employed in molding operations. Most of these employees are semiskilled and operate molding machines which form plastic articles or parts. The molding machine operators are designated according to the type of molding machine they operate—*injection molding machine operator* (D.O.T. 7–10.016) or *compression molding machine operator* (D.O.T. 7–10.014). The basic duties of the operators are to feed plastic materials into the molding machine, start the machine, and take out the molded pieces.

Molding machine operator removing molded electric shaver cases from his machine.

The duties of an *extruder operator* (D.O.T. 6–51.468) are to watch the extruded strips as they are carried from the machine on a conveyor, check for flaws, and correct size. He may cut the strips into pieces or, if it is a film or filament, see that it winds properly on a spool.

In large plants, there is also a *setup man* (D.O.T. 7–83.326) who makes the machines ready for the operators by setting the controls and positioning the molds. He regulates the heat and pressure controls, and makes the other adjustments to the machine as required from time to time. In small plants, the operator performs the setup work.

Finishing and inspection occupations. Plastic products generally undergo a series of finishing operations before they are ready for use. In these operations, the rough edges are removed and decorations or designs are added to the plastic products. A typical finishing job is that performed by a *tumbler operator* (D.O.T. 7–10.935). He places molded pieces in a rotating drum where the excess plastic is removed by friction or by polishing materials. Plastic products must be inspected before they leave the plant. The amount of inspection differs widely, depending upon the plastic product being produced. For some molded products, the workmen need only look over the article for blisters or improper finish. Other products must be examined more closely to see whether they meet more exact specifications. *Inspectors* (D.O.T. 7–10.415) use measuring instruments such as micrometers, dividers, and various types of gages to judge whether finished products are made according to precise specifications.

Toolroom occupations. Although most molding plants buy their molds from firms specializing in this operation, some molding plants, especially the large ones, make their own molds. These plants, therefore, have toolrooms in which *tool and die makers* (D.O.T. 4–76.010) and *machinists* (D.O.T. 4–75.010) are employed. Although these workers make up only a small part of the industry's work force (an estimated 3,500 in 1957), they are the main group of skilled workers employed by plastic products manufacturers.

Tool and die makers use machines and handtools to shape molds from steel. They must be able to read blueprints, use precision measuring instruments, and set up and operate various machine tools, such as lathes and boring mills. Machinists recondition and repair worn or damaged molds and make replacement parts for the various machines in the plant. Machinists must also be able to set up and operate machine tools.

Laminating Occupations. Three typical jobs in laminating work are those performed by coaters, press operators, and mandrel men. The *coater* (D.O.T. 6–51.508) operates the machine that impregnates paper or fabrics with synthetic resins. He places large rolls of paper on the coating machine and directs the course of the material through a resin bath and drying ovens. The dried material is then wound on rolls or cut into sheets. A *laminating press operator* (D.O.T. 6–51.510) runs a hydraulic press which produces sheets of plastic material by pressing the layers of resin-impregnated paper, textile, or other material between steel plates. The operator regulates heat and pressure controls and lowers and raises the press. Where fully automatic equipment is used, the operator's chief function is to check the controls to see that the press is functioning properly. In plants making laminated plastic tubing, a *mandrel man* (D.O.T. 6–51.512) tends a semiautomatic machine which winds resin-impregnated paper or fabric onto heated cores (mandrels). He regulates the thickness of the tube by using simple gaging tools. After the desired thickness is reached, he stops the machine and cuts the material. The tube is then taken to an oven for baking where the process is completed.

Fabricating Occupations. The types of jobs within a fabricating department or plant depend to a great extent upon the plastic material used for manufacturing. When rigid plastic material such as rods or tubes is used, the work is similar to that performed in a woodworking or light-metal production plant. Employees are engaged in bending, beading, buffing, painting, sawing, sanding, drilling, and turning. Some fabricating plant employees are *drill press operators* (D.O.T. 7–10.223 and .224), *lathe operators* (D.O.T. 7–10.222), *assemblers* (D.O.T. 7–10.217), and *finishers* (D.O.T. 7–10.220).

Other Plant Occupations. Some of the other plant workers employed in plastics plants drive trucks and tractors to make deliveries within the plant; some load and unload materials on trucks or trains; and some keep records on inventories of stock and tools. The industry also employs custodial workers such as guards, watchmen, and janitors whose jobs are similar to those in other industries.

Many plants in the industry also employ a maintenance staff consisting of one or more machinists, millwrights, steamfitters, welders, or electricians to maintain and repair machinery and equipment. In most plants, however, a machine operator, or other production worker, may do machine repair and maintenance work in addition to his other duties.

Administrative, Clerical, and Technical Occupations. The plastic products industry employs a relatively small number of professional and technical personnel, since most of the research and developmental work on plastics is done by the large chemical firms. Some of the larger plants, however, do employ technically trained people, such as chemists, engineers, designers, and draftsmen. Most technically trained workers employed in this industry are concerned with developing new plastic products and improving old ones.

Plastic products companies also employ salesmen who must know the properties of plastic products so that they can sell them to purchasing agents and production men in competition with other materials. Production superintendents are employed by many plants to plan and oversee plant operations, and keep the plant running efficiently. Clerks, bookkeepers, accountants, typists, and purchasing agents are among the workers employed in the business offices of plastic products firms.

(Statements on many of these occupations are included in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

Because production methods of the plastic products industry are highly mechanized, most of the jobs are semiskilled and unskilled. With the exception of toolroom and maintenance jobs, previous experience or special training is not required for plant work. The general practice is to hire inexperienced persons and train them on the job. The training period for most of the jobs varies from several days for the less skilled finishing or inspecting jobs to several months for the more skilled molding and laminating operator jobs.

Tool and die makers and machinists learn the skills of the crafts while they are working with experienced craftsmen or through apprenticeship programs. The tool and die maker apprenticeships generally last 4 or 5 years. The programs include practical work experience and classroom instruction in related subjects. In selecting apprentice applicants, most employers prefer young men with high school or vocational school education. In addition, some employers test the apprentice applicants to determine their mechanical aptitudes and mathematical abilities.

Most maintenance workers learn their trade by working as helpers to experienced craftsmen. However, formal apprenticeship programs are available for some maintenance occupations. (Detailed discussions of the duties, training, and employment opportunities for tool and die makers, machinists, and individual maintenance occupations appear elsewhere in this Handbook. See index for page numbers.)

A college degree in chemistry or engineering is generally required for most professional and technical jobs. Salesmen, often called sales engineers, are also required to have some technical training, since a knowledge of the properties of plastic materials and the industrial possibilities of their uses are necessary in selling their company's products.

Employment Outlook

The plastic products industry is expected to provide thousands of job opportunities for new workers during the 1960's. The industry's employment is expected to increase at a faster rate than the estimated 20 percent increase for the Nation's total working population. Employment opportunities should also result from the need to replace workers who retire, die, or transfer out of the industry.

This industry has had a particularly rapid expansion in recent years. New plastic products and the greater use of plastics as a substitute for wood, glass, light metals, rubber, and other materials in consumer and industrial goods resulted in a threefold increase in the industry's value of output between 1947 and 1957. Employment has also shown a rapid growth—increasing from 48,000 in 1947 to approximately 84,000 in 1958. The increasing use of plastics by the automobile industry typifies this growth. The 1958 automobile contained approximately twice the amount of plastics used in the pre-World War II models.

Continued expansion in the production of plastic products is anticipated during the 1960's. Plastic products are expected to do more than maintain their foothold in present markets, and the new uses of plastics currently being developed will result in entirely new markets for this industry. The high level of activity expected for the automobile, aircraft, electronics, and other important industries which use plastic products should contribute to the continued growth of this industry.

Although employment in the plastic products industry is expected to increase substantially during the 1960's, it is not expected to expand as rapidly as production. This has been the industry's experience in recent years. For example, production increased approximately twice as fast as employment from 1947 to 1957. This difference is the result of the growing use of automatic equipment and laborsaving processes. Despite the anticipated continuation of mechanization, the industry is expected to provide thousands of jobs for new workers in the next decade.

Most of the new job openings will be for inexperienced persons who can be trained for production jobs, but there will also be a small number of openings for toolroom, maintenance, and technical personnel.

Earnings and Working Conditions

Production workers in the plastic products industry average $1.98 an hour or $81.77 a week in April 1959. This compares with average hourly earnings of $2.23 or weekly earnings of $89.87 for production workers in all manufacturing industries in the same month. The lower average earnings for production workers in the plastic products industry apparently reflect the high proportion of semiskilled and unskilled workers employed in this industry.

Although comprehensive data are not available for individual occupations, the following wage data collected from some molding manufacturers indicate the range of straight-time hourly rates for males in selected plant occupations in the spring of 1958:

Toolmaker, first class	$1. 90–$4. 00
Steamfitter and millwright	1. 50– 3. 40
Compression molder	1. 50– 3. 00
Compression molder, learner	1. 50– 1. 90
Setup man	1. 50– 2. 60
Injection molder	1. 35– 2. 60
Injection molder, learner	1. 20– 1. 80
Lathe finish operator	1. 50– 2. 20
Inspector	1. 40– 2. 60

The average entry salaries for chemists and chemical engineers in the plastic products industry were among the highest in American industry, according to a 1958 survey conducted by the American Chemical Society. The survey showed that the average starting salary for chemists with a bachelor's degree was $450 a month, and $475 for chemical engineers with a bachelor's degree. Chemists and chemical engineers with graduate degrees received higher starting salaries. Comprehensive earnings data for other engineers and scientists in this industry are not available. (A detailed discussion of earnings in individual professional and technical occupations is included elsewhere in this Handbook in the statement on these occupations. See index for page numbers.)

Many plants operate three shifts. Generally, a premium of 5 cents an hour is paid for the second shift, and 10 cents an hour for the third. Almost all plants provide their employees 1 week's vacation with pay after 1 year of service. Up to 6 paid holidays a year are given by most plants.

Working conditions in plastic products plants are usually good, compared with factory work in general. The buildings are often modern, well lighted, and adequately ventilated. However, molding departments tend to be noisy, and molding machines generate considerable heat. The operators have to wear gloves, since they handle hot plastic pieces. In laminating plants, the odor from the laminating solution may be disagreeable, and the heat near the presses may be bothersome.

The work in this industry is not particularly dangerous. The accident-frequency rate in 1957 was only slightly higher than that for manufacturing as a whole.

Many workers in this industry belong to labor unions. Among the unions which represent workers in plastic products plants are: United Rubber, Cork, Linoleum and Plastic Workers of America; International Association of Machinists; and United Textile Workers of America.

Where To Go for More Information

More detailed information concerning the plastic products industry can be obtained by writing to:

The Society of the Plastics Industry, Inc.,
250 Park Ave., New York 17, N.Y.

RADIO AND TELEVISION BROADCASTING OCCUPATIONS

Every minute of the day and night in all parts of the Nation, radio or television programs are being sent into American homes. The tremendous impact of these broadcasting services in providing entertainment, information, and vital communications has made this industry very attractive to young persons interested in choosing a career. Although broadcasting employment has expanded considerably in recent years, this field of work is still relatively small. More than 85,000 workers (of whom 15,000 worked part-time) were employed in staff broadcasting jobs in 1958. In addition, several thousand employees, who are not included in this industry's employment, were in activities closely related to radio and television broadcasting, such as the preparation of filmed programs and commercials for television presentation.

Broadcasting stations offer a variety of interesting jobs in communities all over the country. Generally, the most specialized and best paying jobs are concentrated in the nationwide networks and large stations which produce most of the elaborate and expensive shows. However, opportunities to enter broadcasting occupations are better in the smaller communities and in the smaller stations.

Nature and Location of the Industry

In 1958, more than 3,200 radio stations and about 510 television stations were broadcasting from cities and towns throughout the United States. About 60 percent of all broadcasting workers were employed in radio.

Most broadcasting stations are independently owned. Many are affiliated with networks which supply programs to the individual stations on the basis of contracts which provide for payment by the network for the use of the station's time. This arrangement makes it possible for these network "affiliates" to broadcast programs which would be much too expensive for them to originate individually. It also enables the networks to offer advertisers national coverage and, as a result, to finance and produce a great variety of costly programs.

Radio stations are served by 4 nationwide networks and more than 80 regional and area networks. The nationwide networks, which originate most of the "live" programs, have affiliated stations in almost every metropolitan area. The regional networks are much smaller, although a few of them include as many as 50 stations. Their network activity usually consists of merely interconnecting for certain events, such as baseball games. Regional and area networks generally do not employ full-time network personnel; their activities are conducted by staff employees of member stations.

Three nationwide television networks provide program service to affiliated commercial stations. Some individual television stations are affiliated with two or three of these networks. The majority of radio stations, however, are not affiliated with a nationwide network; that is, they are independent. Those which are affiliated are usually associated with one of the large networks. Because television stations are considerably more expensive to operate than radio stations, and because there are only a limited number of television channels available, many small cities have only one or two television stations. Thus, the stations

Television cameraman on a crane taking an overhead color picture of studio scene.

in these areas often affiliate with two or three networks in order to offer their viewers a wider variety of programs. Many television programs are broadcast simultaneously from more than 100 stations throughout the Nation.

Radio stations generally have much smaller staffs than television stations. In 1958, radio stations had, on the average, about 20 employees, whereas television stations had about 60. However, the size of the staffs of individual stations varied greatly. A majority of all radio stations had fewer than 15 employees, and only a small proportion had more than 50. Among television stations, only about 10 percent had fewer than 25 workers, about 60 percent had from 25 to 75, and about 30 percent had more than 75. Some of the largest television stations had more than 250 employees.

Radio and television broadcasting jobs are found in every State in the Nation. Almost every community with a population of over 10,000 has at least 1 broadcasting station, and a few of the largest cities have more than 20. Practically all of the large stations are located in metropolitan areas but small stations are found in big cities as well as in small communities. New York and California, which have large concentrations of broadcasting workers in New York City and Los Angeles, the network originating centers, account for about 3 out of 10 broadcasting jobs. Other States which are large and heavily populated, such as Illinois, Texas, Pennsylvania, and Ohio, also have many broadcasting workers because of the large number of individual stations.

Broadcasting Occupations

Broadcasting employees do four general types of work. Employees concerned with programming prepare and present programs; engineering workers operate and maintain the equipment which converts the sounds and pictures into electronic impulses that can be picked up on home receivers; sales workers sell time to advertisers and agencies; and the remaining employees handle general business matters, such as accounting, clerical work, public relations, legal and personnel administration.

In the broadcasting industry as a whole, more than 40 percent of all full-time employees are in programming work. Personnel in the engineering department make up over 20 percent of broadcasting employment. Workers in the sales, publicity, and promotion departments account for about 15 percent, and the remaining workers—about 25 percent—are engaged in business management. Of course, these percentages vary widely among individual stations. Broadcasting stations have staffs ranging from fewer than 5 persons in a small town radio station to more than 250 in the largest television stations. Consequently, job duties and work organization vary greatly from the smallest to the largest stations.

In the small radio stations, a large proportion of the broadcasts consists of transcribed music, weather, and news announcements. If the station is affiliated with a network, often more than half of its time on the air is devoted to network shows. As a result, small stations generally have only a few workers who perform a variety of tasks. The station manager, who in many cases is also the owner, may act as business and sales manager, program director, announcer, and script writer. Announcers in small stations usually do their own writing, often operate the studio control board, and may even act as salesmen. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments on a part-time basis.

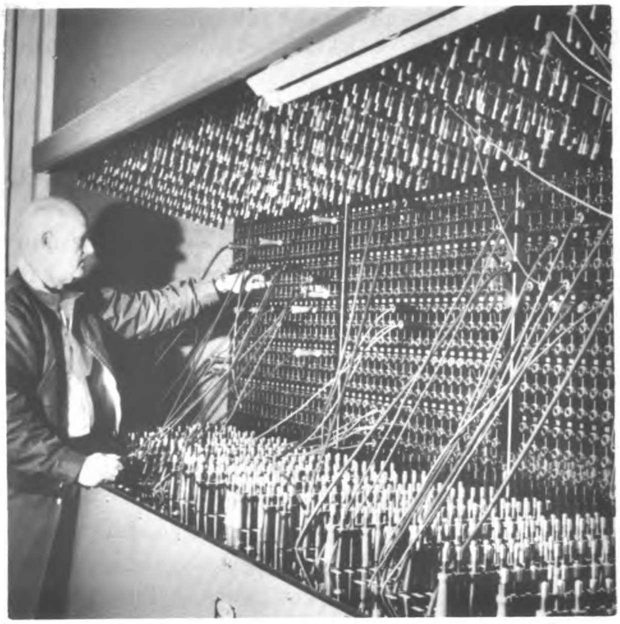
In large stations, jobs are much more specialized and are usually confined to one of the four departments. The kinds of jobs found in each of these departments are described below.

Programming Department. The programming department plans, prepares, and presents radio and television programs. Full-time station employees plan the station's programming, produce the daily and weekly shows, assign personnel to cover special events, and provide general program services such as music, makeup for television performers, sound effects, and lighting. In addition to these station employees, actors, comedians, singers, dancers, top-level announcers, and other entertainers are hired for specific broadcasts or series of broadcasts or for special assignments running over a fixed period. These "free-lance" artists work on a contract basis for either the station or network or for an advertising agency, sponsor, or an independent company which produces programs. (Free-lance artists are not considered staff employees and, are therefore, not included in broadcasting industry employment figures. Most entertainers in radio and television also work in other fields, such as the legitimate theater, nightclubs, or motion pictures.)

The size of a station's programming department depends not only on the size of the station, but also on the extent to which it broadcasts recorded, filmed, or network shows. In small stations, the program functions are handled by a few people who make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. A large television station, on the other hand, may have a program staff consisting of more than 75 people in a wide variety of specialized jobs.

Responsibility for the overall program schedule of a large station rests with the *program director*. He arranges for a combination of programs that will be most effective in meeting the needs of advertisers who buy the station's services and will at the same time be most attractive and interesting to members of the community served by the station. He determines and administers the station's programming policy.

Individual programs or series of programs are planned and supervised by the *director*. In large stations, he may work under the supervision of the *producer*, who assumes responsibility for selection of scripts, financial control, and other overall problems of production. Simetimes these functions are combined in the job of *producer-director*. Selecting appropriate artists and studio personnel, scheduling and conducting rehearsals, coordinating the efforts of all the people involved in the show to produce effective entertainment, and directing the on-the-air show are the director's major responsibilities. He may be assisted by an *associate director*, who takes over such tasks as working out detailed schedules and plans, arranging for distribution of scripts and changes in scripts to the cast, and assisting in directing the on-the-air show. To aid in carrying out the orders of the director and his associates, some stations employ *program assistants*, who help assemble and coordinate the various parts of the show. They arrange for obtaining



Lighting engineer setting up lighting control connections on switchboard of highly elaborate color television lighting system.

props makeup service, art work, and film slides. They assist in timing the on-the-air show, preparing cue cards from the scripts and using them to cue the performers on the show. Many of these jobs are held by women.

Announcers make up the largest and best known group of program workers. In radio and television stations of all sizes, the announcer introduces programs, guests, and musical selections, and delivers most of the commercial messages. (Detailed information on the duties, training, employment outlook, earnings, and working conditions of announcers is given later in this chapter.)

Music is an essential part of radio and television programming. Both small and large stations use recording and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music "libraries," sometimes employ a *music library clerk*, who maintains the music files and answers requests for any particular selection or type of music. In addition to recorded music, a few of the largest stations have specialized personnel who plan and arrange for musical services. The *musical director* selects, arranges, and directs suitable music for programs on general instructions from the director. He selects musicians for live broadcasts and directs them during rehearsals and broadcasts. Musicians are generally hired for particular assignments on a free-lance basis. A few stations employ full-time staff musicians.

Staging a television show is similar in many respects to preparing a program or drama for the legitimate theater. Stations which originate live television shows must have staff members capable of handling the staging jobs. The *studio supervisor* plans and supervises the setting up of scenery and props and other studio and stage equipment for broadcasts. The *floor or stage manager* plans and directs the actors' positions and movements on the set in accordance with the director's instructions, relaying stage directions, station breaks, and cues. The jobs of studio supervisor and floor manager are often combined. *Makeup artists* prepare personnel for broadcasts by applying proper makeup, and maintain supplies and facilities necessary for this work. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other properties to help convey the visual impressions desired by the director. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire, thunder, or falling water, during rehearsals and broadcasts.

About half of the television broadcasting time in 1958 was devoted to filmed programs. For filmed programs, the role of the station's programming staff is limited to preparing the film and timing and scheduling the show. Many stations employ specialized staff members to take care of filmed program material. The *film editor* edits negatives and prints of film or kinescope in accordance with program requirements. He arranges film sequences to establish continuity of action and he may also splice them together. The *film librarian* catalogs and maintains the station's files of motion picture film, which include not only complete programs, but many short sequences that can be fitted into programs to create effects, which are difficult to produce in the studio, such as outdoor action.

Engineering Department. The engineering department of a broadcasting station is responsible for converting the sounds and pictures making up programs into electronic impulses that can be received on home radio and television sets. Placing microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting television cameras to produce clear, well-composed pictures, and lighting television scenes and performers are the main tasks of the engineering staff. They also install, maintain, and repair the many types of electrical and electronic equipment that are required for these operations.

The basic job in the engineering department is that of the *broadcast technician* who is qualified to perform a variety of jobs in the radio or television station. For example, these technicians control the operation of the transmitter to keep the output level and frequency of the outgoing broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations from which remote broadcasts are to be made. (Further information on the duties of broadcast technicians, as well as information on the training, employment out-

Television broadcast technician operating video tape recording equipment.

look, earnings, and working conditions of such personnel is given later in this chapter.)

Stations with more than one or two technicians generally employ a *chief engineer*, who assumes responsibility for all engineering matters. In small stations, he may also work a regular shift at the control board. The large stations have engineers who specialize in such fields as sound recording, motion picture projection, and lighting. A small number of *development engineers* is employed by the networks to design and develop new electronic apparatus to meet special problems.

Sales Department. Broadcasting stations earn their income by selling services to advertisers and agencies. These services consist of time on the air which is allotted to the advertiser's message to the listening or viewing audience. Such announcements, commonly called "commercials," are inserted at specified intervals during programs in accordance with Federal Communications Commission (FCC) regulations and industry standards. Advertisers may buy time as part of a regular daily or weekly show with which they wish to identify their product, or they may simply buy a time segment or "spot" without special reference to the program being broadcast.

Time salesmen, the largest group of workers in this department, sell time on the air to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the station's operations and the characteristics of the area it serves that are of most interest to advertisers, such as population, number of radio and television sets in use, income levels, and consumption patterns. Time salesmen in large stations often maintain a close relationship with particular sponsors and advertising agencies, selling time and acting as a general consultant and advisor to these clients in matters pertaining to advertising through the station. In very small stations, the time salesman may also handle other functions. Many stations sell a substantial part of their time, particularly to national advertisers, through independent sales agencies known as station representatives, which act as intermediaries between time buyers and stations or groups of stations.

Large stations generally have a substantial number of workers who do only sales work. The sales manager supervises his staff of time salesmen, directing their efforts and setting general sales policy. He may also handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to assist the sales staff by analyzing and reporting the market data relating to the community served, the significance of the ratings of the station's programs reported by the rating services, and other types of statistical information.

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Business Management. Like other businesses, broadcasting stations perform a considerable amount of administrative work. In a very small station, the owner and his secretary may handle all the recordkeeping, accounting, purchasing, hiring, and other routine office work. In large stations, executives, such as station managers, have wide responsibilities which vary with the size and scale of operations of the station. Where the size of the station warrants the employment of full-time specialists, the business staff may include accountants, lawyers, personnel workers, and other professional workers. They are assisted by officeworkers such as stenographers, typists, bookkeepers, clerks, and messengers. Building maintenance men are employed in the large stations to keep the facilities in good repair

Training, Other Qualifications, and Advancement

Most of the skilled jobs in broadcasting stations are held by persons who started out in low-level entry jobs, acquired their knowledge and skills over a period of years, and moved up to successively more responsible jobs. For beginning jobs, small stations usually hire young people with at least high school, and preferably some college, education. Some broadcasting employees have had training in technical schools which offer courses designed to prepare young people for various radio and television broadcasting jobs.

Except for technician jobs, specialized training or previous experience is generally not required for entry jobs in broadcasting. However, anyone who operates or maintains a broadcast transmitter must pass the Federal Communications Commission series of technical examinations before he can obtain a Radio Telephone Operator License First Class. Regardless of the specific broadcasting career field in which a person is interested, whether announcing, engineering, sales, or writing, he will find it much easier to obtain a beginning job in a small station if he has this license. Stations with only a few employees sometimes prefer to have as many of them as possible legally qualified to operate the transmitter. A course in electronics at a recognized technical institute is probably the best way of preparing for the FCC test one must pass to obtain the license.

Small stations generally use their personnel in "combination" jobs whose functions cross the lines of the departments found in large stations. Although small stations cannot pay high salaries, they do offer new workers an opportunity to learn all the different phases of broadcasting work.

Often, higher level positions in large stations are filled by persons who have had experience in small stations. However, large stations fill most job openings by hiring new workers for lower level entry jobs and by promoting them to more responsible jobs as they gain knowledge and experience. New people are commonly hired as clerks, typists, pages, messengers, or assistants of various sorts. Persons hired for beginning jobs are usually selected on the basis of their potentialities for learning and for handling the higher level jobs eventually rather than for any specific experience or training. Many persons get started in broadcasting with a temporary job in the summer when workers go on vacation and daylight-hours stations operate for longer hours.

Young people who are interested in broadcasting work will want to know what kinds of transfers and promotions are possible after they have obtained an entry job in a station. In general, people in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees also tend to stay in programming work, although transfers from and to the sales and business services departments are made occasionally. There is easier transferability between sales and administrative jobs because they are often merged in one department in the small stations.

Although transfers of skilled persons between departments are limited to the extent noted, these distinctions are less important in the beginning jobs and also in the top level jobs. Young people hired as typists or page boys, for example, are able to move into program jobs as well as sales and administrative jobs. At the higher levels, a station executive may be drawn from top level personnel of any department.

Employment Outlook

Employment in broadcasting occupations is expected to increase moderately in the 1960's. The rate of growth in these occupations will be somewhat less than the estimated 20-percent increase for the Nation's total working population in the 1960's. A sizable number of new radio and television stations will be opened but most of these will be small and require relatively few employees. Employment in existing television stations is expected to remain relatively unchanged. In existing radio stations, the number employed may decline slightly. In addition to job opportunities created by the industry's moderate growth, many openings will arise when workers in the industry leave their jobs because of retirements, deaths, or transfers to other fields of work. Retirements and deaths will provide about 1,000 job opportunities in the industry each year.

From 1920, when the first daily radio broadcasts were started, until the beginning of World War II, broadcasting employment increased slowly and steadily. After the war, radio experienced a very rapid growth, with the number of radio stations more than doubling between 1945 and 1949. Since then, radio has continued to grow, but at a much slower rate.

In 1947 and 1948, television began to come into prominence as a new broadcasting medium. From 1947 until 1951, the number of television stations increased from 7 to 107. Although this growth was extremely rapid, its impact on total broadcasting employment was slight because television still made up only a small part of the broadcasting industry. During the "freeze" on authorizing new television stations, which lasted from early in 1950 until late in 1953, new stations were not added. However, employment continued to grow, as the existing stations expanded their staffs. After the freeze was lifted, new stations came on the air at an unprecedented rate. By 1958, more than 500 commercial television stations were in operation.

Expansion in both radio and television broadcasting activity more than doubled the industry's employment between 1946 and 1958. Because radio grew rapidly early in this period, and television had its fastest growth later, overall employment grew at a rather steady rate over the entire period.

In the 1960's, the rate of growth in broadcasting employment will slacken considerably. Perhaps 1,000 new radio stations and 50 to 100 new television stations will be put into operation in this period. (If the Federal Communications Commission should change its regulations which determine the number of radio and television stations that can operate, additional stations could go on the air. This would increase employment at a faster rate than is now anticipated.) Since most of the new stations will be small, the resulting employment increase will be moderate, and substantially less than that in the past decade. Employment in existing television stations probably will remain about the same. The increasing trend away from live television programming toward filmed presentations prepared outside of the broadcasting industry is expected to reduce employment in the industry. This reduction would offset any gains resulting from expansion in existing television station services. Employment in existing radio stations may decline slightly because many stations are introducing equipment which controls transmitters without the need for broadcast technicians.

Employment in broadcasting over the next decade or two may also be affected by other developments—technological advances such as magnetic video tape in television and automatic programming in radio, and the growth of color television programming. Like filmed programming in television, the recording and reproduction of live television programs on magnetic video tape could reduce staff employment needs in the broadcasting industry if its use becomes widespread. (At the same time, however, the jobs involved in filmed or taped television programs would be performed in fields closely allied to the broadcasting industry.) Automatic radio programming, another relatively recent technological advance, could reduce employment requirements because it permits radio stations to provide unattended programming service to the public. Finally, color television broadcasting probably will become firmly established within the next decade but, with the exception of some increase in programming and technical jobs in the network centers, color television will have little effect on total broadcasting employment.

Earnings and Working Conditions

Earnings of broadcasting workers range from $40 a week for beginning clerical workers in small stations to more than $10,000 a year for established and highly skilled announcers, engineers, directors, and time salesmen in large stations. Employees in large stations generally earn considerably more than workers in the same types of jobs in small stations and in small communities. Persons who work in network stations generally have the highest earnings.

Working conditions in broadcasting stations are usually very pleasant. The work is done in clean, attractive surroundings. It is performed indoors except where remote pickups are involved. Jobs in programming are particularly attractive because of the glamour attached to this field of work and the opportunities it affords for high earnings and artistic expression.

Most broadcasting employees have a scheduled 40-hour workweek. Sales and business services workers generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, and weekends. Some employees, particularly in the small stations, work 42-, 44-, and 48-hour weeks regularly, receiving overtime pay for the extra hours.

Many unions operate in the broadcasting field. They are most active in the network centers and large stations. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicians, wardrobe attendants, makeup men, and cameramen. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Radio and Television Directors Guild organizes program directors, associate directors, and stage managers.

Radio and Television Announcers

(D.O.T. 0–69.21)

Nature of Work

About 10,000 staff announcers were employed on a regularly scheduled, full-time basis in radio and television broadcasting stations in 1958. They announce news and commercial messages, identify stations describe sporting events, and introduce programs. In small stations, they may perform additional duties such as operating the control board or selling time. Staff announcers in large stations, have more specialized duties confined to the programming department. In addition to announcing, they may act as masters of ceremonies, conduct interviews, and participate in other ways in locally originated shows.

Many announcers act as "disc jockeys," introducing selections of recorded music and commenting on the music and other matters of interest to the audience. Disc jockeys must "ad lib" much of their commentary, working without a detailed script.

In addition to staff announcers, an estimated 10,000–15,000 "free-lance" announcer specialists sell their services for a fixed period on a contract basis to networks, stations, advertising agencies, and other independent producers for both programs (news, sports, disc jockey, etc.) and commercials.

Training, Other Qualifications, and Advancement

Announcing is a job in which personal characteristics are very important. To succeed in radio, one must have a pleasant, well-controlled voice; in television, rather high standards of personal appearance must also be met. A person who is considering a career as an announcer, therefore, should judge his own personal characteristics realistically. If one's voice or general appearance does not create a pleasant impression, he will be handicapped as an announcer. Because of the ever changing nature of the work, an announcer must be able to think fast and handle unusual situations effectively. Most announcers are men, but there is a trend toward employing more women announcers, especially in television, where their appearance is an asset. An announcer must have a thorough knowledge of English grammar and usage. A broad educational background is also very helpful.

Many announcers get their first broadcasting jobs in small stations, where they are frequently required to perform a number of other program duties, such as writing script and news copy. Announcers in small- and medium-size stations sometimes handle work outside the program department, such as operating controls or selling time. For this reason, prospective announcers often obtain a FCC Radio Telephone Operator License First Class, which makes them legally eligible to operate the transmitter and, therefore, much more valuable to these stations. In large stations, it is sometimes possible for young persons to start out as clerks, messengers, or page boys and gradually work into announcers' jobs. A number of schools offer training in radio and television announcing.

Many announcers work in several different stations in the course of their careers. After acquiring experience in a small station, an ambitious and talented announcer may move to a better paying job with a larger station. He may then improve his status by working into a regular program as a disc jockey, sportscaster, or other specialist. Some of the more successful announcers become well known and highly paid personalities in the large stations.

Employment Outlook

Employment of announcers will increase moderately in the 1960's as new radio and television stations are opened. It is expected that about 1,000 radio stations and about 50 to 100 new television stations will go on the air in this period. Additional television announcers may also be required where existing stations extend their broadcasting schedules. Some job openings in this relatively small occupation will also result from retirements, deaths, and transfers to other fields of work. The growth of the industry and replacement needs together will create, on the average, about 400 to 500 openings for announcers each year in the coming decade. It will probably be easier to get a beginning job in radio than in television because of the greater number of radio stations, especially small stations, which hire beginners. However, the great attraction of this field and its relatively small size will result in keen competition for available jobs.

Earnings and Working Conditions

Earnings of individual announcers depend considerably on the size and location of the station and the extent of special fees and commissions they receive. Announcers in small stations are generally paid a fixed weekly or monthly salary. In 1958, most announcers in small stations earned from $60 to $75 per week. In medium-size stations, earnings generally ranged from $80 to $110. Many experienced announcers in large metropolitan stations earned more than $150 per week. Included in the earnings of many better paid announcers were fees received from advertisers which added to the salary received from the station. Announcers able to work into regular positions on a station's shows as, for example, well-known disc jockeys or announcers who become identified with popular network radio or television programs, earn considerably more than salaried announcers. In medium and large communities, some of these specialists earn much more than $10,000 a year.

Announcers often work evenings, nights, and weekends. Their work hours consist of both time on the air and time spent in preparing for broadcasts, and vary from job to job. In stations with very small staffs, announcers generally perform a variety of other duties. Working conditions are generally very pleasant owing to the variety of work and the many personal contacts which are part of the job. Announcers also receive some satisfaction from having their names become well known in the community.

Broadcast Technicians

(D.O.T. 0–66.00 through .09)

Nature of Work

Technicians in broadcasting stations service the electronic equipment which transmits the sounds and pictures from the studio to the air. These workers, called broadcast, transmitter, studio, maintenance, or recording technicians operate the transmitters, read transmitter meters, and compile written records. They operate television cameras, microphones, and sound recording, sound effects, and motion picture projection equipment. Other duties of these technicians include the operation and maintenance of the studio's electronic equipment and the setting up of equipment for remote pickups. In addition, operation of the transmitter requires the technician to monitor and adjust the output levels and frequency of the outgoing broadcast.

The job of the broadcast technician which requires the most technical knowledge is that of setting up, maintaining, and repairing the intricate electronic equipment in the station. Picking up the sounds and pictures in the broadcasting stations, converting them into electrical impulses, and getting the signal to the transmitters is done by means of microphones, video cameras, cables, and other electronic transmission and amplification equipment. When trouble develops in any

Workers in a control room during a television program include the program director and his assistant, and broadcast technicians.

of this equipment, the technician repairs it and puts it back into operation. Most large radio and television stations employ one or two experienced maintenance technicians whose chief duties are to repair and service equipment under supervision of the chief engineer or his assistant.

When events taking place outside the studios are to be broadcast, technicians go to the site of the pickup and set up the necessary equipment. They test the equipment after it is installed and then stand by to make any emergency repairs. After the broadcast, they dismantle the equipment and return to the station.

About 14,000 nonsupervisory broadcast technicians were employed in the engineering departments of radio and television stations in 1958. More than half of the broadcasting stations were small enterprises employing from 2 to 4 technicians. However, the large stations in large metropolitan areas employ the majority of broadcast technicians. The highest paying and more specialized jobs are concentrated in New York, Los Angeles, Washington, D.C., and Chicago, the originating centers for most of the network programs.

In addition to the nonsupervisory technicians, an estimated 5,000 supervisory personnel, with job titles such as chief engineer, assistant chief engineer, director of engineering, and supervisory technician, also do technical work in the engineering departments. These personnel supervise the operation, maintenance, and repair of all electronic equipment in the studio and at the transmitter. In small radio stations, they frequently do all the maintenance and repair work themselves. Supervisory personnel may also design and build new equipment, purchase equipment for the station, and help lay out plans for building new studios and towers. Many of these technical personnel are broadcast technicians who have worked their way up to supervisory positions, but some have academic degrees in engineering.

Training, Other Qualifications, and Advancement

A young man interested in becoming a broadcast technician should plan on getting a Radio Telephone Operator License First Class from the Federal Communications Commission. Federal law requires that any person who operates or maintains broadcast transmitters in television and radio stations must hold such a license. Many stations require all their broadcast technicians, including those who do not operate transmitters, to have this license. Applicants for the license must pass a series of written examinations covering the construction and operation of transmission and receiving equipment, the characteristics of electromagnetic waves, and Government and international regulations and practices governing broadcasting. Information about these examinations, and guides to studying for them, may be obtained from the Federal Communications Commission, Washington 25, D.C.

Perhaps the best way to acquire the knowledge necessary for becoming a broadcast technician is to take an electronics course in a technical school. Many schools provide courses especially designed to prepare the student for the FCC test and to qualify him for a beginning job in a broadcasting station.

Young men with FCC licenses who are hired into entry jobs at large stations are instructed and advised by the chief engineer or other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties after a brief instruction period. As they acquire more experience and skill, they are assigned to more responsible technician jobs. Men who demonstrate above average ability may move into the top level technical positions, such as supervisory technician and chief engineer.

Employment Outlook

Employment of broadcast technicians probably will increase slightly in the 1960's. The approximate 1,000 new radio stations and the 50 to 100 new television stations which are expected to go on the air during this period will create a moderate number of additional jobs for technicians. Retirements, deaths, and transfers to other jobs will also create some job openings in this relatively small occupation.

Color television broadcasting will probably become widespread during the next decade. As a result, most stations will have to make some changes and additions to their cameras and other pickup and transmitting equipment. Color television equipment is more complicated than black and white, and will probably require more maintenance in its first few years of use. Originating a color show will require some additional technical work in the lighting and photographing of the various scenes and actions. These developments will moderately increase the need for technicians. On the other hand, the growth of technician jobs in broadcasting will be slowed as a result of the increasing introduction of automatic equipment such as automatic switching and programming devices, remote control of transmitters, and magnetic video tape machines.

Earnings and Working Conditions

Broadcast technicians are a relatively well-paid group of skilled workers. Their earnings vary greatly with the size of the station and the community. Although in 1958 beginning salaries for technicians ranged from about $50 to $75 a week in small stations, experienced men earned from about $80 a week in small towns to more than $150 in large cities. Many technicians in the networks and large stations earned more than $185 a week. Supervisory technicians below the rank of chief engineers in the networks and large stations often earned in excess of $200 a week. Chief engineers earned still higher salaries.

Most technicians in large stations work a 40-hour week, with overtime pay rates for work beyond 40 hours. In small stations, technicians often work 2, 4, or 8 hours of overtime each week on a regular basis. Evening, night, and weekend work occurs frequently since some stations are on the air as many as 24 hours a day, 7 days a week.

Broadcast technicians generally work indoors in pleasant surroundings. The work is interesting and there is often considerable variety of work duties, especially in large stations. When remote pickups are made, technicians may work out of doors at some distance from the studios.

OCCUPATIONS IN THE RAILROAD INDUSTRY

The railroads, with their network of more than 200,000 miles of rail line reaching into all parts of the country, are one of the country's largest employers. About 1 million workers were employed in 1958 operating trains, looking after the needs of the traveling public, maintaining and repairing facilities and equipment, and carrying on the hundreds of other activities required in this industry. These activities offer a great variety of interesting careers. Regardless of the occupation the new worker may enter, however, he usually gets ahead in railroading only by starting at the bottom of the ladder and working his way up by learning his job, proving his ability, and acquiring the seniority which will enable him to advance.

Nature and Location of the Industry

The railroad industry is made up chiefly of the "line-haul" railroad companies which transport freight and passengers between cities and towns, and the switching and terminal companies which operate facilities at stations, stockyards, and other terminal points. In 1958, there were a total of about 625 of these operating railroad companies. In addition, the Pullman Company performs special services for passengers traveling on these railroads.

Slightly more than 100 line-haul railroads and about 50 switching and terminal companies are in a group known technically as class I railways. (Each of these companies has operating revenues of $3 million or more a year.) The remaining companies in the industry are in the class II group; most of them are the so-called short line railroads, each of which usually operates only a limited number of miles of track.

The class I line-haul railroads, which include all of the large well-known companies, handle 99 percent of the railroad industry's business and employ about 95 percent of all railroad workers. With 30,000 locomotives, another 30,000 passenger train cars, and nearly 2 million freight cars, they transported 1.4 billion tons of freight and over 400 million passengers in 1957. (For employees of class I line-haul railroads, the Interstate Commerce Commission periodically reports on employment and earnings. These data have been used in this chapter to illustrate employment and earnings throughout the entire railroad industry.)

The passenger part of the railroad business is the one most familiar to the traveling public. From the standpoint of the money it brings in to the railroads, however, it is far less important then the freight service. Receipts from hauling coal, ore, grain, lumber, and other commodities by freight amounted to more than 10 times as much as the revenue from passenger service in 1957. Other sources of railroad revenue include mail and express services.

The railroads serve every part of the Nation and consequently the workers employed on the trains, along the right-of-way where tracks and other railroad facilities are located, and in railroad stations, yards, and offices are to be found in every State in the union. The greatest numbers, however, are located at various points where the railroads maintain their central offices, freight yards, and maintenance and repair shops. The metropolitan area of Chicago, where the great eastern and western railroad systems meet, is the hub of the Nation's railroad network and has more railroad workers than any other area. Other places where particularly large numbers of railroad workers are employed are the metropolitan areas around New York City, Pittsburgh, Philadelphia, Los Angeles, Cleveland, and St. Louis. "Railroad towns" where locomotive and car shops are located, such as Altoona, Pa., and Roseville, Calif., also have relatively large concentrations of railroad workers.

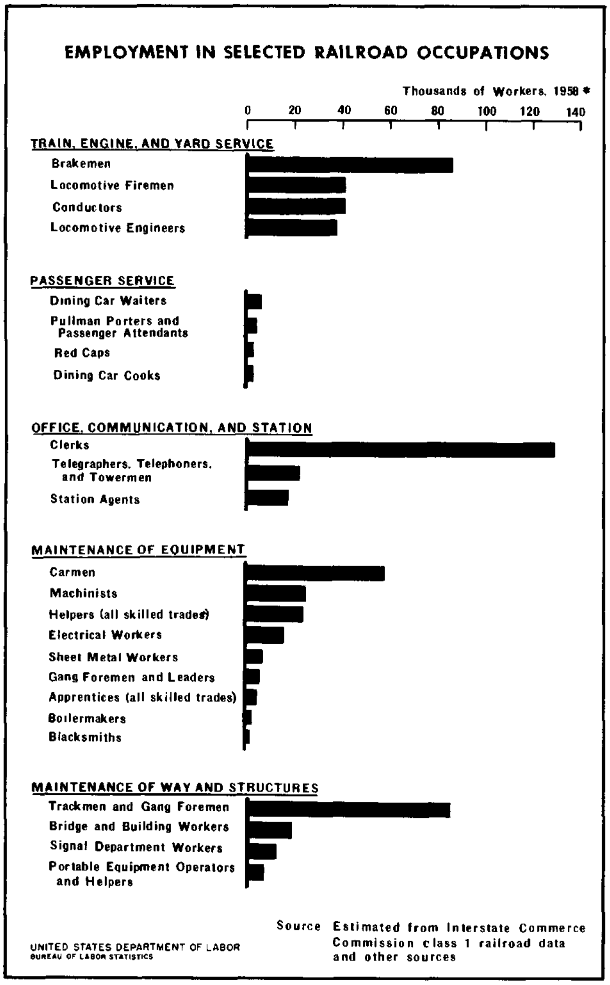
Railroad Occupations

The work force of the railroad industry can be divided into five main groups—employees who (1) operate the trains, (2) handle luggage, prepare and serve food, and provide other personal services to passengers, (3) perform the communications, station, and office work, (4) build and maintain the rolling stock, and (5) build and maintain the tracks, structures, and other railroad property. In 1958, 95 percent of the workers in railroad jobs were men. Most of the women employed by the railroads do office work of various kinds.

Chart 48 shows the number of employees in some of the principal railroad occupations. Other occupations in which the railroads employ many persons, but which are not shown on the chart, range from professional positions such as accountants, engineers, and statisticians to unskilled laundry and cleaning jobs. (Information about some of them is given elsewhere in this Handbook. See index for page numbers.)

The workers directly concerned with running the trains are known as "operating employees."

CHART 48



They represent one-fourth of all railroad workers. On class I line-haul railroads, there were about 206,000 operating employees in 1958. In this group are locomotive engineers and firemen, as well as conductors, brakemen, and on some passenger trains, baggagemen. These men work together, either operating trains out on the "run" as train crews, or else operating trains at the terminals and railroad yards where freight is loaded and unloaded, freight cars are received and switched, and trains are broken up and made up. Other operating employees working in the yards include switchtenders, who assist conductors and brakemen by throwing the track switches, and hostlers, who service locomotives with fuel, check their operating condition, and deliver them to the train crews.

The second group of railroad workers is engaged in providing personal services to passengers at stations and aboard trains. With less than 25,000 employees in 1958, or little more than 2 percent of all employed in the railroad industry, it is by far the smallest of the five groups. It includes Pullman conductors who, on most roads, collect sleeping car and parlor car tickets, as well as porters and attendants who perform many kinds of personal services for passengers traveling in their cars. This second group also includes cooks and waiters who prepare and serve food on dining and buffet cars, and redcaps who work in and around railroad stations where they handle luggage and otherwise assist passengers in boarding and leaving trains.

The largest group of railroad workers, almost one-third of all those employed in the industry, consists of communications, station, and office employees who regulate the movement of trains and take care of the business affairs of the railroads. In 1958, class I line-haul railroads employed about 275,000 persons in such jobs. Communications are handled by dispatchers who coordinate the movement of trains and issue train orders, and by telegraphers, telephoners, and towermen who either pass train orders and other instructions on to the train crews or carry them out by setting signals and track switches. At each station, a station agent is in charge of the railroads' business affairs. Railroad clerks work in stations and company offices where they may do secretarial and other kinds of office work, assist station agents, deal with customers, sell tickets, tend baggage rooms, keep records, and perform related tasks. Also included in this third group of railroad workers are claims investigators, accountants, lawyers, motor vehicle operators, patrolmen, and watchmen.

Another fourth of all railroad workers are employed in railroad yards, carshops, and engine houses where they maintain and repair locomotives, cars, and other railroad rolling stock. The class I line-haul roads employed 196,500 workers in this group in 1958. Carmen perform a variety of repair and maintenance tasks necessary to keep railroad freight and passenger cars in good operating condition. Electrical workers, machinists, boilermakers, blacksmiths, and sheet metal workers are also employed in the shops, each contributing his particular skill to the maintenance of the rolling stock.

A considerably smaller group, about one-sixth of the total, are employed to maintain and construct tracks, bridges, stations, signals, and other railroad property; the class I line-haul railroads employed about 134,000 in work of this kind in 1958. Trackmen and other maintenance-of-way workers maintain, construct, and repair tracks and roadbeds. Bridge and building mechanics construct and maintain bridges, tunnels, and many other kinds of structures along the right of way. Signal workers are responsible for installing the railroad's vast network of signals and for keeping it in efficient working order.

Training, Other Qualifications, and Advancement

Because the railroad industry employs workers in a wide range of occupations, training and educational requirements vary greatly. For most jobs, particularly those on the trains, in the yards, and around the stations, training is received on the job. The new employee learns his job by working and receiving instruction from experienced men. For some office and maintenance jobs, training may be obtained in high schools and vocational schools. Home study courses that add to a worker's practical knowledge of railroading are also available. In addition, universities and technical schools offer college courses in railway engineering, transportation, traffic management, and other subjects which are of value to professional and technical workers.

New employees in some occupations—principally those connected with train or engine service—start as "extra board" men, by having their names placed on lists of workers who are given temporary assignments as men are needed to handle extra heavy traffic or to fill in for men who are absent from their regular assignments because of illness or vacations. As permanent job assignments become available and as the extra board workers gain experience and seniority, they are assigned permanently to regular positions. The time spent on extra board work varies with the type of job and the number of available openings. In some cases workers may not receive permanent assignments for a number of years.

Apprenticeship programs are limited chiefly to training for employment in the railroad shop crafts. Many of these programs are jointly planned and operated by the companies and the railroad workers' unions. Of the several thousand men who were taking this kind of training in 1958, the majority were "regular" apprentices, usually high school graduates with no previous work experience, who were working and receiving instruction in their chosen trades for a 4-year period; others were "helper" apprentices, men with some previous experience as railroad workers who were receiving the same kind of training, usually for a 3-year period.

Applicants with a high school education or its equivalent are preferred by railroad companies for most kinds of nonprofessional positions. Good physical condition is required for most jobs, and almost all large roads require physical examinations before applicants are hired. Excellent hearing and eyesight are essential for train and engine service jobs, and color blindness is an absolute bar to employment in any kind of work involving the interpretation of railroad signals.

Promotions of qualified workers are generally made on the basis of seniority. Most types of job vacancies are listed on a bulletin board, and all workers who are interested may "bid" for them. The job goes to the qualified applicant whose length of service places him highest on the seniority list. Often, before workers can qualify for promotion, they must pass written and performance tests. For occupations in train and engine service, there are well-established avenues of promotion: Engineers are always chosen from the ranks of the firemen, and conductors from the list of brakemen.

A railroad worker's seniority usually entitles him to consideration for promotion only in connection with job openings which occur within a limited area or "seniority district" of the railroad system for which he works. In some cases, seniority rights may apply only to one shop, locality, or office. Among train and engine personnel, seniority rights are usually limited either to freight and passenger service, or else to yard service, and workers may bid only for positions in the particular type of service in which they have been employed.

The worker's seniority also determines how much choice he may have with respect to the conditions under which he does his work. A beginning telegrapher, for instance, may have to work several years on a night shift in an out-of-the-way location before he acquires enough seniority to secure an assignment which does not have these disadvantages.

(Later sections of this chapter contain more complete information about the training and other qualifications for specific occupations in the railroad industry.)

Employment Outlook

Even though the total number of persons employed by the railroad industry is expected to continue to decline during the 1960 decade, there will be opportunities for thousands of new workers. The railroads have one of the largest workforces in American industry, with a high proportion of older workers, and many jobs will become vacant because of retirements, deaths, and transfers to other fields of work.

Although the situation will differ from one company to another, during the 1960's, opportunities for new workers will probably be best in the shops, in construction work along the right of way, and in some kinds of communications and office work. It will probably be more difficult to obtain jobs in highly specialized railroad work such as that done by train and engine crews and by certain communications workers. This is because many specialized workers, now furloughed as a result of recent force reductions, will find it relatively difficult to obtain jobs at the same skill level outside the railroad industry. Consequently, they are more likely to return to railroading when they have an opportunity to do so, and the railroads, before hiring new workers from the outside, will first offer available jobs to qualified workers who have been placed on furlough.

The recent decline in railroad employment is part of a long-term downward trend which has been under way since the 1920's. In 1958 there were approximately one-half as many railroad workers as there were in 1920. On the class I line-haul roads, employment declined from 1,330,000 in 1948 to 845,000 in 1958—a drop of 36 percent.

One of the reasons for this decline in employment has been competition from other kinds of transportation—notably automobiles, trucks, buses, airplanes, and pipelines. During the period 1948–58, while the total volume of freight and passenger traffic handled by public carriers of all kinds was steadily increasing, the amount of business handled by the railroads nevertheless declined. Freight traffic (revenue ton-miles) declined an estimated 15 percent, and revenue passenger-miles almost 45 percent.

Another important factor from the standpoint of its effect on employment has been the improvement in railroad equipment and methods of operation that has been taking place during recent years. For example, the diesel locomotive which has largely replaced the steam locomotive, is capable of hauling longer trains at higher speeds and it requires less maintenance; the use of diesels has been a factor, therefore, in reducing employment for train and engine crews as well as for maintenance workers. Overall manpower requirements have been reduced also through developments such as modernized freight classification yards, automatic signaling and communications systems, mechanization of maintenance-of-way operations, and the use of data-processing machines in railroad offices. Along with these reductions in manpower requirements, however, some new job opportunities are developing for workers with specialized knowledge of the maintenance, installation, and operation of the new kinds of equipment which are coming into more and more general use—electronic devices, for instance.

During the 1960's, the Nation's total freight traffic is expected to rise considerably, because of the anticipated general economic expansion and increase in industrial production. Since the railroads will probably continue to handle about half of all the Nation's freight traffic, some expansion in railroad freight operations is in prospect. Passenger traffic carried by the railroads is expected to continue to decline, however, since air carriers will probably attract more and more long-distance travel and short-distance passengers, formerly carried in railroad coaches, will make more and more use of private automobiles and buses.

On the basis of anticipated volumes of freight and passenger traffic and further technological advances in railroad operation, an overall decline in employment is indicated in the railroad industry during the next several years. Should Federal legislation designed to improve the position of the railroads be enacted, as has been proposed in recent years, this decline in employment may be less pronounced than would otherwise have been the case, or may not even materialize. Despite the prospect of declining employment, however, replacement needs in an industry with such a large number of employees, a large proportion of whom are older workers, will provide thousands of job opportunities for new workers during the 1960's. It is estimated that replacement needs due to retirements and deaths alone will result in about 200,000 job openings during the 1960's.

Earnings and Working Conditions

Average earnings of railroad workers are higher than those of workers in most manufacturing industries. Employees of class I line-haul railroads, exclusive of executives and administrative personnel, averaged $109.39 a week in February 1959. In the same month, production workers in all manufacturing industries combined averaged $88 a week.

The earnings of individual railroad workers vary greatly because of the great variety in the occupations and skill requirements in this industry. Regional differences in wage levels are considerably less than in most other industries, since the wage scales specified in many labor contracts are identical in all parts of the country. For most workers, basic wage rates are automatically increased when the cost of living rises. Earnings in some of the principal occupations are discussed in later sections of this chapter.

The great majority of railroad workers are members of trade unions and many of the conditions under which they work are regulated by collective bargaining agreements. Contracts between the unions and the railroad companies contain clauses dealing with wage rates, hours of work, vacation pay, seniority, and other matters. The principal unions representing each occupational group are listed in the sections of this chapter which deal with individual occupations.

The work schedules of railroad employees and the conditions under which they are paid for overtime work depend upon the type of service in which they are employed. The great majority of railroad employees work at terminals, and in yards, stations, and railroad offices. In 1958, the "basic" week for most workers in this group was a 5-day week of 40 hours. Premium pay amounting to time and one-half was usually paid for any time worked over 8 hours a day.

The basic workday for train and engine crews in freight and passenger service is established on an entirely different basis. Generally, when a member of the train or engine crew has run a specified number of miles, or worked a certain number of hours—whichever occurs first—he is paid for a full day's work at his regular wage. He receives extra pay for any additional miles run or hours worked on that day.

The basic hours of employees directly concerned with looking after the needs of passengers aboard trains—dining car cooks and waiters, Pullman porters, and train attendants—are set on a monthly basis. In 1958, workers in these jobs received time and one-half for hours worked over 244 a month. All of those employed on permanent assignments were guaranteed at least 205 hours of work a month.

Because freight shippers and the traveling public must be served 24 hours a day, the members of train and engine crews, as well as hostlers, telegraphers and telephoners, and station agents, are often required to work nights, weekends, and on holidays. Irregular work schedules are particularly common for extra board workers, since they have no permanent assignments and may be called to work any time of the day or night. Some railroad workers, like bridge and building mechanics, are required to work away from home for days at a time.

Practically all railroad employees receive a 1-week paid vacation after 1 year on the payroll, 2 weeks after 5 years, and 3 weeks after 15 years of service. On many roads, nonoperating employees and some classes of yard workers receive pay for 7 holidays a year when they are not required to work.

Under the federally administered Railroad Retirement Act, all employees with more than 10 years of service in the railroad industry receive pensions on retirement. They receive full pensions when they reach 65 years of age and partial pensions at age 60, provided they have worked for the railroads for at least 30 years. Employees who become disabled and are unable to continue to work, and the dependent wives and husbands of insured railroad workers who have died also receive pensions under the law. During the period 1956–57, the average pension paid to railroad workers who were retired because of age or disability was about $120 a month, and the average pension paid to survivors of railroad workers was about $47 a month. (Early in 1959, these benefits were increased by approximately 10 percent.)

Another Federal law, the Railroad Unemployment Insurance Act, provides benefits for railroad workers who become unemployed. In 1958, these benefits ranged from $34 to $42.50 a week, and unemployed workers could be paid for a period as long as 26 weeks.

Under the Railroad Unemployment Insurance Act, railroad workers also receive compensation for workdays lost because of sickness or injury. The amount of the benefits paid is the same as the amount paid in the case of unemployment. Other insurance programs, operated under agreements with trade unions, provide nonoperating employees and their dependents with comprehensive hospital and medical insurance as well.

Where To Go for More Information

Additional information about occupations in the railroad industry can be obtained from railroad offices in your locality. General information about the railroad industry can be obtained from:

Association of American Railroads,
Transportation Building, Washington 6, D.C.

Locomotive Engineers

(D.O.T. 5–41.010)

Nature of Work

The engineer is responsible for running the locomotive safely and efficiently. He operates the throttle, air brakes, and other controls, and he supervises the work of the fireman who works in the cab with him. The engineer may work in a railroad yard or on the road in passenger or freight service.

The yard engineer operates the locomotive or switchengine, which is used to move freight and passenger cars when trains are being made up before a run and broken up after a run, or when cars are being switched, loaded, and unloaded. The engineer in passenger or freight service operates the locomotive which moves trains over the road in accordance with the train orders for each run or any instructions received en route through the conductor, the wayside signal system, or by train radio.

Before and after each run, the engineer checks on the condition of the locomotive and either sees that minor adjustments are made on the spot or reports back to the yard on any mechanical defects needing attention. With the assistance of the fireman, he watches for obstructions on the track, and checks his reading of wayside signals and other instructions.

In 1958, there were about 38,000 engineers employed by class I line-haul railroads, and a few thousand more employed by short-line railways and switching and terminal companies. The class I railroads employed 16,100 in the yards, about 15,900 in freight service, and 6,000 in passenger train service.

An engineer at the controls of a diesel locomotive communicates with members of the train crew by radio.

Training, Other Qualifications, and Advancement

Vacancies which occur in engineer positions are filled by firemen who have qualified for promotion. Selection is on a seniority basis. In order to qualify, a fireman must pass comprehensive examinations which deal with the train's mechanical and electrical equipment, and with fuel economy, safety, timetables, train orders, and other operating rules and regulations. He must also be able to operate any kind of locomotive in service on his road.

A newly promoted engineer starts out as an extra board man without any permanent assignment. It may be several years before he receives a regular full-time assignment. During this period he works on temporary assignments whenever an engineer is needed. An experienced engineer may advance to a supervisory position such as foreman of engines for his road.

Engineers are required to take physical examinations at regular intervals. It is particularly important that they have good eyesight and hearing. If they fail at any time to meet all of the physical standards required, they may be restricted to working as engineers only in certain types of service, or they may be transferred to other kinds of work where physical standards are less exacting.

Employment Outlook

The total number of engineers employed by the railroads is expected to decline during the 1960's, and opportunities for new workers to enter this occupation will be limited. Locomotive engineers are one of the oldest age groups in the Nation's work force, and most of the openings that occur will arise from the need to fill positions left vacant by engineers who retire or die. Many of these positions will be filled by experienced men whose jobs as engineers were terminated during recent years because of cutbacks in railroad services and who resumed working as firemen.

The number of engineers employed by the railroads has been declining for some years because of the decrease in railroad business and the introduction of diesel engines, "pushbutton" freight yards, and other changes in railroad equipment and operating methods. The total employed by class I line-haul railroads dropped from 49,500 in 1950 to 38,000 in 1958. Some further decrease in the employment of engineers is expected during the 1960's.

Earnings and Working Conditions

The earnings of engineers vary according to the class of locomotive operated and the kind of service in which the engineer is employed. Engineers in yard service for class I line-haul railroads (including extra board men) earned an average of about $600 in the month of November 1958. In through freight service, engineers averaged $665 and in local and way freight service $800. The earnings of passenger service engineers averaged about $785 during the same month.

In 1958, yard engineers worked a basic 40-hour week of five 8-hour days, and for work beyond 8 hours daily they were paid at one and one-half times their regular rates. Road service engineers received, in addition to their regular day's pay, extra pay whenever they operated the locomotive more than 100 miles over the road or (in passenger service) worked longer than 5 hours a day or (in freight service) worked more than 8 hours a day.

On many roads, the amount a road engineer may earn in a single month is restricted by mileage limitations agreed upon by the unions and the railroad companies. Whenever an engineer on one of these roads reaches the top number of miles he is permitted to operate a locomotive during a month, his assignment for the rest of the month is taken over by another engineer—usually an extra board man.

The engineer in road service, even though on a regular assignment, is often scheduled to work nights, weekends, and holidays. Like other workers in road service, he must often "lay over" away from home for a period of time at the end of a run before he makes the return trip back to his home terminal. At such times, he must pay for his own meals and other living expenses he may incur.

The assignments of engineers on the extra board may be very irregular, since these men may be called to work at any time of the day or night, and on many roads the amount of traffic varies from one season to another. Extra board engineers are also likely to have less work, with the result that their earnings may be lower than those of men with regular assignments.

On all major railroads, wages and the conditions under which engineers work are agreed upon by employers and unions. The great majority of engineers are represented by the Brotherhood of Locomotive Engineers (Ind.). A few are represented by the Brotherhood of Locomotive Firemen and Enginemen.

Locomotive Firemen (Helpers)

(D.O.T. 5–42.100)

Nature of Work

The locomotive fireman (or "helper" as he is called when working on a diesel locomotive) works with the engineer either in the railroad yards or in road service. On diesel locomotives, he operates mechanical and electrical controls which assure the continuous flow of power needed to drive the locomotive. On the limited number of steam locomotives in use today, he operates the mechanical stoker, regulating the flow of fuel and water in order to maintain the proper steam pressure.

At the beginning of each run, the fireman checks to make sure that the locomotive is supplied with the fuel and water needed for the run, that the engine is in proper working order, and that the flagging equipment, classification markers, and tools needed by the engine crew are on hand and ready for use. During the run, he makes mechanical and electrical adjustments as needed to keep the engine in proper working order. He is responsible for operating the equipment which supplies heat to the train. From his position at the left side of the cab, the fireman also assists the engineer by acting as lookout for obstructions on the tracks, for grade crossings, and for wayside signals which indicate the speed at which the train is to proceed. In addition, he makes "running inspections" of the train when it rounds curves and this affords him a chance to look back for mechanical defects such as dragging equipment and hot boxes.

The fireman must be prepared at any time to take over the controls of the locomotive, should the engineer become ill. An important part of his job, therefore, is learning to operate the locomotive by observing the engineer. Often he may be called upon to relieve the engineer at the controls for brief periods, or take the controls for a "practice run."

Class I line-haul railroads employed about 40,500 firemen in 1958, and short-line railways and switching and terminal companies a few thousand more. Of the firemen on class I roads, 18,200 worked in the railroad yards, 17,100 in road freight service, and about 5,200 in passenger service.

Training, Other Qualifications, and Advancement

Most railroads prefer that applicants for positions as firemen be at least 21 years of age and not over 30 or 35. A high school education or its equivalent is desired. Good health is important, and firemen must be able to pass periodic physical examinations. Standards as to eyesight and hearing are particularly high.

A fireman starting out on his job first makes a series of trial trips in the railroad yard or on the road. On these trips, he works under the direction of an experienced engineer or fireman who instructs him about his future duties and about railroad rules and regulations. This training period lasts for a few days on some roads and for as long as 3 weeks on others. After the newly hired fireman has satisfactorily demonstrated his ability on the trial trips, and after he has passed examinations on railroad rules and regulations, his name is placed on the firemen's extra board and he becomes subject to call for temporary work assignments as men are needed. He may remain on extra board work for a period of time which can range up to several years before he obtains his first regular assignment. On some roads, beginning assignments are in yard service and the fireman works his way up later to road freight service and then to road passenger service. On other railroads, firemen usually remain either in yard service or in road service throughout their railroad careers.

Fireman with sufficient experience and seniority —usually at least 3 or 4 years—can become eligible for promotion to the positions of engineers by passing qualifying examinations covering the mechanical and electrical equipment on trains, air brake systems, fuel economy, timetables, train orders, and other operating rules and regulations. As engineers are needed, the names of qualified firemen with the greatest seniority are placed on the engineers' extra board.

Employment Outlook

There will be a moderate number of opportunities for new workers to obtain jobs as firemen during the 1960's. Job openings will arise chiefly because of the need to replace firemen who advance to jobs as engineers, transfer to other kinds of work, retire, or die.

Changes in road equipment and yard-operating methods, together with the decline in railroad traffic, caused the number of locomotive firemen employed by class I line-haul railroads to decline from 51,500 in 1950 to 40,500 in 1958. During the 1960's, the expected decline in passenger service and further changes in yard-operating methods will probably result in a further decline in the number of firemen employed. Another factor limiting the number of opportunities that may develop for new workers to obtain jobs as firemen is the practice of transferring to positions as firemen those engineers whose jobs are terminated because of reductions in railroad services.

Earnings and Working Conditions

The earnings of firemen vary with the class of locomotive on which they work and the type of service for which it is operated. Firemen in yard service for class I line-haul railroads (including extra board men) averaged $455 in November 1958. Freight service firemen averaged $635 on local and way freight trains, and $505 on through freight trains. Road passenger firemen averaged $660 in the same month.

In 1958, firemen in yard service worked a basic 8-hour day and 40-hour week, and one and one-half times the hourly rate was paid firemen for work beyond these hours. Firemen in road service received extra pay after they had traveled more than 100 miles or worked (in passenger service) longer than 5 hours a day or (in freight service) more than 8 hours a day. On many roads, the amount that firemen in road service could earn in a single month was restricted by mileage limitations agreed upon by the unions and the railroad companies. Whenever a fireman on one of these roads reached the maximum number of miles he was permitted to cover in a month, his assignment for the rest of the month was taken over by another fireman—usually a man on the extra board.

Firemen must often work at night and on weekends and holidays because train schedules require 24-hour-a-day service. Road service often requires that they be away from their home stations for varying periods of time; on these occasions, firemen must pay their own living expenses. Irregular working hours are particularly common among men on the extra board, and extra board men tend to have less work and therefore lower incomes than firemen with regular assignments. On many roads, the amount of work to be done varies from one season of the year to another.

Workers in this occupation are covered by union contracts on all major roads. The great majority of firemen are represented by the Brotherhood of Locomotive Firemen and Enginemen. A few are members of the Brotherhood of Locomotive Engineers (Ind.).

Conductors

(D.O.T. 0–92.00 through .29)

Nature of Work

Conductors are responsible for seeing that railroad cars are moved according to train orders or other instructions, either when the train is on its run or when cars are in the railroad yards. Freight and passenger train conductors are the "captains" of their trains. They are responsible for the safety of their cargoes and passengers, and they supervise the work of the train crews.

Before a freight or passenger train leaves the terminal, the conductor receives the train orders from the dispatcher and confers with other crew members to make sure they are understood. During the run, he sees that the cars in the train are inspected periodically and arranges either for the repair of mechanical breakdowns while the train is on its run, or for defective cars to be set out on the nearest siding. At stops, he signals the engineer the proper time for departure. As the superior officer on the train, the conductor takes charge in any emergency that may occur while the train is on its run, and all persons employed on it are subject to his instructions.

On freight trains, the conductor keeps a record of the contents and destination of each car, and he sees that freight cars are picked up and set out along the route. On passenger trains, the conductor collects tickets and cash fares.

Yard conductors, who are often called "yard foremen," direct the work of the switching crews who make up and break up trains. In mechanized yards, they operate the car retarders by means of which the movement of cars is controlled electronically.

Of the 40,500 conductors employed by class I line-haul railroads in 1958, about 13,900 were in freight service, 4,800 on passenger trains, and 19,100 in yard service; 2,700 were employed as assistant passenger conductors and ticket collectors. Switching and terminal companies and short-line railways also employed several thousand conductors.

Training, Other Qualifications, and Advancement

Openings for conductors are filled on a seniority basis by promoting qualified brakemen. To qualify for promotion, a man usually must have had several years' experience as a brakeman, and must have passed examinations covering signals, air brakes, timetables, operating rules, and related subjects. On some roads, experienced brakemen who have qualified for promotion are first given temporary assignments as conductors while they are still working as brakemen. On other roads, brakemen promoted to conductor positions are put on the extra board where they are given temporary assignments as men are needed. In either case, as permanent assignments become available, they go to the men with the greatest seniority.

On most roads, conductors in yard service and in road service have separate seniority lists, and they usually remain in one of these two types of service throughout their careers. A few roads, however, start conductors out on yard assignments, and then move them to freight service and finally to passenger service.

The conductor is the member of the train crew who has the most direct contact with the public and it is important that he be the kind of person who can act effectively as the railroad's representative. Conductors who show special ability of this kind may advance to managerial positions. Several top railroad executives were once conductors.

Employment Outlook

There will be a moderate number of opportunities for brakemen to be promoted to jobs as conductors during the 1960's, even though the total number of conductors is expected to decline during this period. Conductors are one of the oldest age groups in the Nation's work force, and job openings will develop principally as a result of the need to replace those who retire, die, or leave railroading for some other reason. The number of conductors on class I line-haul railroads declined from 46,500 in 1950 to 40,500 in 1958, owing to the trend toward longer trains and the mechanization of yard operations. As more and more of the yard conductors' work is speeded up by the use of new devices such as radar "eyes" and closed-circuit television, it is

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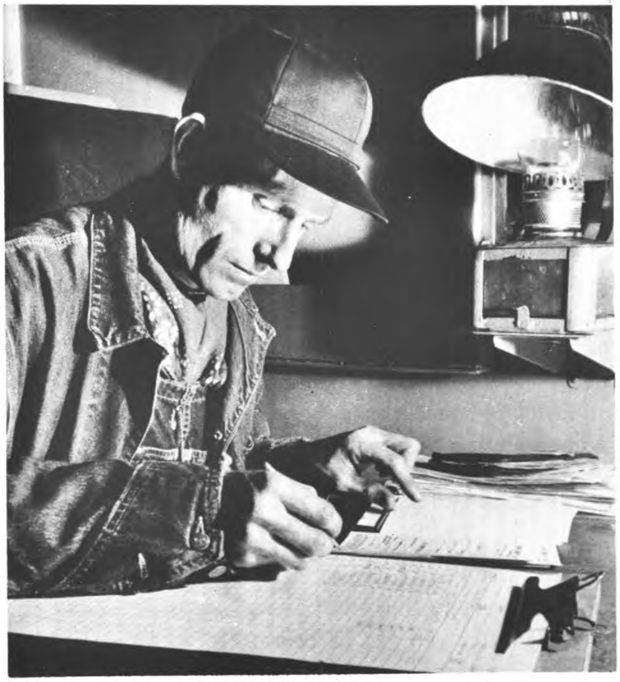

A freight conductor filling out a report on the cars delivered and picked up during a run.

expected that the number of conductors will continue to decline in the 1960's.

Earnings and Working Conditions

The type of service in which they are employed and the number of cars in their trains determine the earnings of conductors; for work in mountainous regions they receive extra pay. In November 1958, yard conductors employed by class I line-haul railroads earned an average of $560. In road freight service, conductors on local and way freight trains averaged $750, and conductors on through freight trains averaged $630. The average for passenger conductors was $685 and for assistant passenger conductors and ticket collectors $540 in the same month.

In 1958, conductors in yard service worked a basic 8-hour day and 5-day week. For work beyond these hours they were paid one and one-half times their basic wage rates. Passenger service conductors received extra pay when they traveled more than 150 miles a day or worked more than 7½ hours. On freight trains, extra pay was given after the conductor had traveled 100 miles or worked for more than 8 hours.

Like all other road crew members, conductors in freight or passenger service are often scheduled to work nights, weekends, and on holidays. During the time spent "laying over," after one run has been completed and before the conductor makes the return trip back to his home base, he must pay for his own meals and any other living expenses. Conductors on extra board work often have very irregular hours because they are subject to call at any time. They may also work less time than conductors with regular assignments and so they tend to earn less.

Conductors on every major railroad are covered by union contracts. Freight and passenger conductors are represented principally by the Order of Railway Conductors and Brakemen (Ind.) or the Brotherhood of Railroad Trainmen. Yard conductors (or yard foremen) have been organized by the Brotherhood of Railroad Trainmen and the Switchmen's Union of North America.

Brakemen

(D.O.T. 5–38.010 and .020)

Nature of Work

Brakemen work with the conductors as members of the train crews on freight and passenger trains and in the railroad yards. One brakeman (or "flagman") is generally stationed in the rear of each freight and passenger train; his duties include seeing that the proper flags, warning lights, and other signals are displayed at the rear of the train in order to protect it while it is in motion and at stops. Most freight (and some passenger) trains carry at least one other brakeman who is stationed in the engine cab at the front of the train and whose duties include putting out signals to protect the front of the train at unexpected stops.

Before a train leaves the station, the brakeman in road service checks the air brakes on the cars and sees that tools and other equipment are in their proper places. At stops during the run, he makes "walking inspections" of the cars in the train and, when necessary, couples and uncouples cars and air hose. He is responsible for regulating the air-conditioning, lighting, and heating equipment in the cars. Brakemen in passenger service (often known as "trainmen") sometimes have the added duty of assisting the conductor by collecting tickets and generally looking after the needs of the passengers. Yard brakemen (frequently called "switchmen" or "helpers") assist in making up and breaking up trains by throwing switches, coupling and uncoupling freight and passenger cars, and riding on them to control their speed as they are moved about the yard.

Brakemen make up one of the largest occupational groups in the railroad industry. About 86,000 were employed in 1958 on class I line-haul railroads—about 46,500 in yard service, 33,900 in freight service, and 5,600 on passenger trains. In addition, several thousand brakemen worked for short-line railways and switching and terminal companies.

Training, Other Qualifications, and Advancement

A brakeman starting out as a new worker first makes several trial trips with an experienced brakeman or conductor, during which he familiarizes himself with the road and receives instructions about his future duties. After he has demonstrated his ability on trial trips, the new brakeman is put on extra board work and given temporary assignments as men are needed. Brakemen generally must work at least a year on the extra board before they learn the job thoroughly, and several more years before a vacancy occurs and they acquire enough seniority to move on to regular assignments.

Employers prefer that applicants for positions as brakemen have a high school education or its equivalent, and that they be at least 18 years of age (21 years on some roads) and not older than 30 or 35. Applicants must be able to pass physical examinations with particularly strict requirements as to eyesight and hearing.

Yard brakemen may advance to positions as yard conductors; usually they stay in yard service throughout their railroad careers. On some roads, brakemen in road service may move from freight into passenger work, which is usually considered more desirable because it is less strenuous than freight service and sometimes involves shorter working hours.

When they have acquired sufficient seniority, brakemen in road service may advance to positions as conductors. Less frequently, they go on to positions as baggagemen. Conductor positions are nearly always filled by promoting brakemen who have qualified by passing written and oral examinations covering such subjects as signals, timetables, brake systems, and operating rules. Promotions are made according to seniority rules, and it sometimes takes up to 10 years or more for a brakeman to get his first assignment as a conductor.

Employment Outlook

Several thousand opportunities for new workers to obtain jobs as brakemen will develop during the 1960's, even though the total number of brakemen employed by the railroad industry is expected to decline during this period. Job openings will develop almost entirely as a result of retirements and deaths of conductors and brakemen and because of promotions and transfers to other work. During the 1950's, the number of brakemen employed by class I line-haul railroads declined slightly—from 102,000 in 1950 to 86,000 in 1958. During the 1960's, work in railroad yards is expected to become increasingly mechanized, with the use of automatic car retarders, automatic switching, and other devices. This is expected to result in a further decline in the employment of brakemen.

Earnings and Working Conditions

The number of cars in the train and the type of service in which he is employed determine the earnings of a brakeman; extra pay is given for work in mountainous country. The average monthly earnings of yard brakemen employed by class I line-haul railroads were $440 in November 1958. Brakemen on through freight trains averaged $510 and those employed on local and way freight trains averaged $645 in the same month. The average for passenger train brakemen was $590.

In 1958, brakemen in yard service had a 5-day, 40-hour basic workweek, and for work beyond this they were paid one and one-half times their regular hourly rates. Brakemen in road freight service were given extra pay after they had traveled more than 100 miles or worked longer than 8 hours in one day. Passenger train brakemen received extra pay after 150 miles or 7½ hours of work.

Like other members of train and engine crews, brakemen are often scheduled to work nights and on weekends and holidays, and they pay their own living expenses while on duty away from their home terminals. Brakemen who are on the extra board and have been employed by the railroad for only a short time tend to have less steady work and lower earnings than men with regular assignments, and they may also work more irregular hours. Yard and freight brakemen face considerably greater accident risks than most other railroad workers.

The great majority of brakemen are represented by the Brotherhood of Railroad Trainmen. The Order of Railway Conductors and Brakemen (Ind.) has organized freight and passenger brakemen on a few roads, however, and the Switchmen's Union of North America has organized some yard brakemen.

Pullman Porters and Passenger Attendants

(D.O.T. 2–91.10)

Nature of Work

Pullman porters make up berths in sleeping cars, keep the cars in order, see that washrooms are clean and adequately supplied with towels, and handle luggage. They make trips more comfortable and enjoyable for passengers by doing such things as helping invalids and otherwise attending to passengers' personal wants, answering questions about the route the train is taking, and restoring lost or forgotten property left by passengers. Porters must know how to operate the heating, lighting, and air-conditioning equipment on Pullman cars. Porters-in-charge, who are employed on some trains that do not have Pullman conductors, collect Pullman tickets, sell space and keep records, in addition to handling regular porter duties.

A pullman porter learning from a porter instructor about one of the service "extras" provided for passengers.

On club cars and other cars where refreshments are served, passenger attendants prepare and serve beverages and light meals and also perform any necessary porter work. On some roads, busboys assist the attendants on large club cars.

In 1958, the Pullman Company employed about 3,600 porters, mainly on sleeping cars, and about 300 passenger attendants and 100 busboys. Line-haul railroads operating their own sleeping cars employed an additional 500 porters.

Training, Other Qualifications, and Advancement

Applicants for porter jobs should be between 21 and 45 years of age, and be able to read, write, and make simple mathematical calculations. To qualify for an attendant's job, it is desirable for a man to have had experience as a busboy or porter. Applicants for all of these jobs undergo physical examinations, and those who handle food are reexamined every 90 days.

Porters starting out on the job go through a training period of approximately 2 weeks, during which they get instruction from a porter-instructor, and work on a train under the supervision of an experienced porter. After this training period, the employee works as a porter for a 6-month probationary period. He starts out on the extra board, and is given temporary assignments as men are needed, and later, when he has gained seniority, bids for a regular assignment.

Busboys as well as porters may be promoted to attendant positions when openings occur. Porters may become porters-in-charge or porter-instructors.

Employment Outlook

A limited number of opportunities in these small fields will arise in the 1960's because of retirements, deaths, and transfers to other occupations. Although a few new workers may be hired for porter and attendant work, particularly for temporary seasonal needs, most of the jobs that become available will probably go to furloughed workers. Porters and attendants, like other groups whose employment depends mainly on the volume of first-class (Pullman) passenger traffic, have been decreasing in number in recent years, and the number is expected to continue to decrease in the 1960's.

Earnings and Working Conditions

In 1958, porters, attendants, and busboys working on permanent assignments for the Pullman Company were guaranteed a monthly wage based on 205 hours of work. While extra board men did not have a guaranteed wage of this kind, the company nevertheless tried to schedule enough work for them to maintain their earnings at no less than two-thirds of the basic month's pay. All hours worked by porters, attendants, and busboys, up to a total of 240 a month, were paid for at straight-time rates. Time and one-half was paid for work in excess of 240 hours a month.

In 1958, the basic rates for porters (representing pay for 205 hours of work a month) ranged from $401 a month for beginning workers to a maximum of $412 after 15 years of service. Comparable rates for attendants were $403 for beginners and $413 for those with 15 years or more of service. Busboys started at $400 and reached a maximum of about $410 a month after 15 years of service. In addition to these basic monthly rates, porters, attendants, and busboys receive tips which often vary with the type of service performed for passengers.

On night runs, sleeping-car porters are provided sleeping accommodations. The porter in the adjacent car services the car of the porter released for sleep. Porters pay the cost of most of their uniforms. When on a run, they may buy dining car meals at approximately 60 percent of the regular price.

Most porters are represented by the Brotherhood of Sleeping Car Porters.

Dining Car Cooks

(D.O.T. 2–26.40 through .49)

Nature of Work

Dining car cooks prepare the meals served on trains. There may be from one to four cooks in a dining car kitchen, depending on the size of the kitchen and the number of customers expected. When four cooks are employed, each has specialized tasks. The chef keeps a record of the supplies on hand and supervises the work of the kitchen crew, roasts and carves meats and poultry, and garnishes dishes. The second cook fries and broils meat, bakes muffins and rolls, and puts the food on the plates. The third cook prepares soup, vegetables, and coffee and works at the steam table. The fourth cook, or "helper," is the vegetable peeler, dishwasher, and general clean-up man. Many dining cars carry fewer than four cooks, and each man is therefore required to perform some additional tasks. Approximately 3,000 dining car cooks were employed by the railroads in 1958.

(Information about the nature of the work performed by other cooks, employed in restaurants operated by the railroads, may be found elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

The railroads prefer applicants who have a high school education and some experience in the preparation of food. Applicants for jobs as dining car cooks are required to pass strict physical examinations and undergo tests for communicable diseases periodically thereafter.

New workers generally begin as fourth cooks and are given only temporary assignments. As the cook gains experience, he is usually assigned to a regular run. After 2 or 3 years' experience, a fourth cook may be promoted to third cook. He may remain in this job for 5 or more years before becoming a second cook, after which it generally takes an additional 3 to 5 years to work up to the position of chef.

Employment Outlook

Opportunities for new workers to enter this small field in the 1960's will be very limited in number. In 1958 a great many cooks were laid off and placed on furlough. Before new workers are hired to fill openings which occur during the next several years, these furloughed employees will be called back either to fill temporary jobs which become available because of seasonal peaks in passenger service, or to replace men who retire, die, or leave the occupation for some other reason.

Like other groups whose employment depends mainly on the volume of passenger traffic, dining car cooks have been decreasing in number during the past decade, and the number is expected to continue to decrease in the 1960's.

Earnings and Working Conditions

Basic monthly rates paid in 1958 for a 205-hour month ranged from about $400, or almost $2 an hour, for fourth cooks, to $500, or $2.45 an hour, for chefs. Overtime hours worked, up to a total of 240 a month, were paid for at regular basic rates, and overtime in excess of 240 hours was paid for at time and a half. The railroads furnish the coats and aprons worn. When cooks are away from their home terminals, they are provided free meals and sleeping quarters.

Disabling injuries are more frequent among cooks than among many other groups of railroad workers because cooks work with sharp knives and near hot stoves, and the sudden jerks and swaying of the dining car increases the danger of cuts or burns.

The majority of cooks and chefs are organized by the Hotel and Restaurant Employees and Bartenders International Union.

Dining Car Waiters

(D.O.T. 2-27.95)

Nature of Work

These workers are employed by the railroads to serve meals in dining cars. Many dining cars carry a full crew of six waiters, each of whom has several specific duties in addition to taking orders from customers, serving them food, and removing dishes from tables. Two waiters serve as "pantrymen" and are responsible for the proper storage of food and the preparation of salads. One waiter takes care of the linen and water bottles, while another washes, cleans, and polishes the larger pieces of silverware, such as sugar bowls, ice tubs, and finger bowls. Another waiter is responsible for the flat silver and glassware, and the remaining waiter keeps the floors clean. When the crew of waiters is smaller, each man handles several of these assignments. In 1958, the railroad industry employed almost 6,500 dining car waiters.

Training, Other Qualifications, and Advancement

Previous experience as a waiter is an asset to men seeking positions with the railroads. Railroads prefer high school graduates who are in their early twenties, fairly tall, and of pleasing appearance. Each new waiter is given a thorough physical examination and is tested for communicable diseases periodically thereafter. Advancement for waiters is limited. A few waiters may become waiters-in-charge who supervise the operation of very small dining cars or refreshment cars serving light meals. On some roads, waiters may be promoted to positions as stewards in charge of dining car staffs.

Employment Outlook

A limited number of job opportunities for new workers in this small field will arise in the 1960's, primarily to replace experienced waiters who retire, die, or transfer to other fields of work. Some new workers may be hired also for temporary assignments during seasonal peaks in passenger service. In 1958, there were many experienced waiters who had been laid off and placed on furlough, however, and these furloughed workers will be given opportunities for reemployment before any new workers are hired to fill jobs that become available.

Employment of dining car waiters has declined rather sharply since 1950. Like other groups whose employment depends mainly on the volume of passenger traffic, dining car waiters are expected to continue to decrease in number in the next decade.

Earnings and Working Conditions

Waiters generally worked 205 hours each month and for this received about $400 in 1958, or almost $2 an hour, plus their tips. For any extra hours which they worked each month, up to a total of 240, they were paid at their regular hourly rate; for any time worked which was over 240 hours a month, they received time and one-half pay. Waiters who serve as pantrymen are paid a few dollars extra each month, and those who go through the railroad coaches selling sandwiches and other items receive a small commission on their sales. The coats and aprons worn are furnished by the railroads.

Waiters are organized primarily by the Hotel and Restaurant Employees and Bartenders International Union.

Telegraphers, Telephoners, and Towermen

(D.O.T. 1–41.22 and 5–44.020)

Nature of Work

Telegraphers, telephoners, and towermen are concerned with controlling the movement of trains in accordance with instructions issued by the train dispatchers. Telegraphers and telephoners receive train orders from the dispatchers and pass them on to the train crews. Towermen operate the controls which throw track switches and set signals in order to route traffic according to train schedules or special orders. To some extent, the three jobs are interchangeable. For example, many towermen also act as telegraphers and telephoners in transmitting orders, and some telegraphers and telephoners spend part of their time operating signals. Telegraphers, telephoners, and towermen work either in railroad stations or in towers located in yards, terminals, and other important junction points along the railroad's right of way. Often, at the largest stations and towers, either a chief telegrapher, a chief telephoner, or wire chief, or chief towerman (train director) is in charge of the work.

Telegraphers and telephoners may transmit information about train orders, as well as other types of communications relating to the railroad's business, by Morse Code, radio telephone, telephone, and teletype or some similar device. Morse Code, which was once generally used for this purpose, is gradually being replaced by the telephone. Particularly at the smaller stations, telegraphers may often sell tickets or do clerical work in addition to their other duties. (In most small stations, there are no telegraphers, since the station agent combines this work with his other duties).

Class I line-haul railroads employed about 21,000 workers in the telegrapher, telephoner, and towerman group in 1958. About 1,200 were chief telegraphers and telephoners, and 400 were chief towermen. About 12,000 worked practically full time as telegraphers, telephoners, and towermen, and about 7,400 combined telegraphing and telephoning with clerical duties in stations. Short-line railways employed several hundred more of these workers.

The towerman routes cars in a freight yard by throwing switche with the push of a button.

Training, Other Qualifications, and Advancement

Most telegraphers, telephoners, and towermen receive their training on the job, working under the supervision of experienced telegraphers, station agents, or towermen. They are instructed about their future responsibilities, including operating rules, train orders, station operations, and the Morse Code. A few beginning telegraphers take 6- to 7-month courses at railroad telegraph schools and then spend 2 or 3 months in training at a station. On many roads, trainees must pass examinations on train operating rules as well as practical tests on other duties relating to their future assignments before they can qualify for permanent positions as telegraphers, telephoners, or towermen.

A few roads place newly hired workers on the extra board, where they serve on temporary assignemnts as men are needed and, after acquiring sufficient seniority, bid for regular assignments as telegraphers, towermen, clerk-telegraphers, and station agent-telegraphers.

Most railroads prefer applicants for beginning positions to be high school graduates between 21 and 30 years of age. Applicants must pass physical examinations which have strict eyesight and hearing requirements.

A man with the necessary experience and seniority may be promoted to a position as station agent or train dispatcher.

Employment Outlook

There will be a few hundred opportunities for new workers to become student operators each year during the 1960's, even though employment in this occupational group is expected to decline somewhat. The openings that occur will result primarily from the need to replace experienced workers who retire, die, or transfer to other occupations.

Employment on class I line-haul railroads in the telegrapher, telephoner, and towerman group dropped from 26,500 in 1950 to 21,000 in 1958, and it is expected to continue to decline in the next decade. The mechanization of yard operations, the use of dispatcher-to-train radio hookups and other new communications devices, and the extension of centralized traffic control and other automatic signaling systems are reducing the number of workers needed to help control the movement of trains.

Earnings and Working Conditions

The average monthly earnings of clerk-telegraphers and clerk-telephoners on class I line-haul railroads in November 1958 were $415; telegraphers, telephoners, and towermen averaged $420. The earnings of student telegraphers, who work only part of the time and spend the remainder studying, were considerably lower. Chief telegraphers and telephoners and chief towermen averaged, respectively, $495 and $520 in the same month.

Telegraphers worked a basic 40-hour week of five 8-hour days in 1958, with time and one-half paid for overtime. Under Federal law they are prohibited from working more than 9 hours in any one day, except in emergencies.

Most telegraphers, telephoners, and towermen are members of The Order of Railroad Telegraphers.

Station Agents

(D.O.T. 1—44.22)

Nature of Work

Station agents are the railroads' official representatives in dealing with the public at railroad stations. Most agents work at small stations where they sell tickets, check baggage, calculate freight and express charges, load and unload freight and express packages, and perform many other tasks. They may also serve as telegraphers and telephoners, receiving and delivering train orders and other messages pertaining to the company's business. In larger stations, some of this work may be done by railway clerks, telegraphers, and other employees working under the station agent's supervision. In major freight and passenger stations with many railroad employees, the duties of the station agent are primarily administrative and supervisory.

About 18,500 station agents were employed by class I line-haul railroads in 1958. About 16,400 worked in small stations (12,500 of them acting as telegraphers and telephoners in addition to their other duties), and 2,100 had supervisory positions at major stations. The short-line railways employed several hundred more agents, chiefly at small stations.

Training, Other Qualifications, and Advancement

Positions as agents in small stations or assistant agents in larger ones are usually filled by promoting experienced telegraphers. Less frequently, railroad clerks may advance to station agent positions. To secure promotion to an agent position, a man must not only have the necessary seniority, but he must have gained a knowledge of train schedules and routes, rates, bookkeeping methods, signals, and other railroad business transacted at wayside stations.

Station agents may advance from small to larger stations or from positions as assistant agents to agents. They may be promoted to supervisory positions such as stationmaster or inspector.

Employment Outlook

A limited number of opportunities for promotion to station agent jobs will arise each year during the 1960's, principally because of the need to replace agents who retire, die, or transfer to other kinds of work. For some years the number of station agents employed by class I line-haul railroads has been declining; between 1950 and 1958, employment dropped from a little less than 21,000 to a little less than 18,500, principally because some local passenger and freight services were discontinued. It is expected that the railroads may discontinue additional passenger services during the 1960's, with the result that the total number of station agents employed will decline further.

Earnings and Working Conditions

The salaries of station agents vary according to the size of the station and the nature of their duties. In November 1958, the earnings of agents who also served as telegraphers and telephoners on class I line-haul roads averaged $410; other agents at small stations who did not act as telegraphers averaged $450. Agents at major stations earned an average of $610 in the same month.

Most agents were paid either by the hour or by the month in 1958; those in nonsupervisory positions had a basic 40-hour workweek, and time and one-half was paid for overtime work. Whenever agents handled the business of the Railway Express Agency, they received, in addition to their regular pay, a commission on the business transacted.

Many station agents are members of The Order of Railroad Telegraphers.

Clerks

(D.O.T. 1–01.31; 1–11.02 through .15; 1–18.74, .93, .97; 1–26.03; 1–13.01, .10; 1–34.02, .04; 1–36.01)

Nature of Work

Railroad clerks handle the huge volume of paper work necessary to keep an account of each piece of rolling stock, and transact business with freight shippers and the traveling public. They work in railroad stations, freight houses, yards, terminals, and company offices, and they make up the largest single group of railroad employees. Class I line-haul railroads employed about 128,000 of these workers in 1958, and short-line railways, thousands more.

The majority of railroad clerks—80,300 on class I line-haul railroads in 1958—do clerical work connected with business transactions such as collecting bills, investigating complaints, adjusting claims, tracing shipments, compiling statistics, selling tickets, and keeping books. In small offices and stations, one man may perform duties related to several of these jobs, but in large offices with many employees, each clerk usually handles a specialized job.

A second group, totaling 22,900 in 1958, consists of secretaries, stenographers, typists, and operators of calculating, bookkeeping, and other kinds of office machines. As employees of railroad companies, they perform duties similar to those of workers in the same kinds of jobs in other industries. (Information about the nature of these duties may be found elsewhere in this Handbook. See index for page numbers.)

In 1958, class I line-haul railroads employed more than 10,800 other railroad clerks in higher grade "senior" jobs involving more responsible or technical work. Some of the clerks in this group prepare the statistics on employment, traffic, and other matters relating to railroad operations which are required periodically by the Federal Government. Others, called "cashiers," deal with customers on such matters as uncollected freight bills. Still others do accounting work related to their companies' use of terminals and other facilities which are owned jointly by several roads.

A fourth group are the supervisory and chief clerks. In 1958, they numbered about 14,000 on class I line-haul railroads. They not only supervise the work of other railroad clerks and assume responsibility for the work of entire departments, but they may be called on to deal with highly complex problems related to the business end of railroad operations.

Training, Other Qualifications, and Advancement

Beginning railroad clerk positions are often filled by hiring newcomers or by promoting workers such as office boys or messengers who are already employed by the company. A high school education is usually required, and clerical aptitude tests are sometimes given. The railroads prefer workers who have had training or some experience in working with figures. Some roads assign beginning workers in a few kinds of positions—yard clerks, for instance—to extra board work where they work on temporary assignments until such time as permanent assignments become available.

In many offices, a railroad clerk may advance to assistant chief clerk or chief clerk, or to a higher administrative position. Some clerks may move from routine jobs to work requiring special knowledge of subjects such as accounting or statistics, and this work may lead eventually to positions as auditors or statisticians. Railroad

Railroad clerks use filing wheels to sort waybills by date and number.

clerks may also be promoted to jobs as traffic agents, buyers, storekeepers, or ticket and station agents.

Employment Outlook

Even though employment in clerical positions is expected to decline somewhat during the 1960's, several thousand job opportunities for new workers will become available each year. This is a large occupational group and retirements, deaths, and transfers to other fields of work will create many openings for new workers.

Employment in this occupational group has been declining. In 1950, class I line-haul railroads employed about 152,000 railroad clerks; in 1958 only 128,000 were employed. A continued decrease in the employment of these workers is expected, as electronic data-processing machines do more of the work formerly done by railroad clerks in processing freight bills and recording information about freight car movements and freight yard operations.

Earnings and Working Conditions

Employees of class I line-haul railroads who did clerical work connected with business such as collecting bills and investigating complaints earned an average of $405 in November 1958. Secretaries, stenographers, typists and, office machine operators averaged $400; senior clerks and specialists averaged $460; and supervisory and chief clerks, $530 in the same month. Railroad clerks in nonsupervisory positions work a basic 8-hour day and 40-hour week, with time and one-half paid for overtime.

The Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees represents the railroad clerks on all major roads.

Redcaps

(D.O.T. 2–92.30)

Nature of Work

Redcaps work at passenger stations and terminals, carrying baggage for railroad passengers, either by hand or on trucks. They check luggage, make telephone calls, and perform other services for travelers. They also answer questions on such subjects as train schedules and the tracks on which particular trains will arrive or depart. At a few stations, they stock the timetable racks, and do cleaning and other work. About 3,000 redcaps were employed in 1958, either by railroad companies or by companies operating railroad terminal facilities and concessions furnishing this service in stations and terminals.

Training, Other Qualifications, and Advancement

Hiring standards for redcap jobs vary from company to company. As a rule, the railroads prefer applicants who are at least 18 or 21 and not over 45 years of age. The prospective redcap must be able to read and write and must be strong enough to carry heavy baggage. Physical examinations are required.

Promotional opportunities for a redcap are limited chiefly to positions as assistant captain or captain in charge of all redcaps at a station.

Employment Outlook

There will be only a small number of opportunities for new workers to obtain jobs as redcaps during the 1960's. Openings will arise primarily from the need to replace redcaps who retire, die, or transfer to other fields of work. As openings develop, however, almost all of them are likely to be filled by redcaps who have been furloughed in force reductions in recent years, or by furloughed railroad workers who have been employed in other kinds of jobs. Like other groups whose employment depends mainly on the volume of railroad passenger traffic, redcaps have been declining in numbers in recent years and this decline will probably continue in the 1960's.

Earnings and Working Conditions

Wage rates specified for redcaps in union contracts averaged $2 an hour in 1958. In addition to their basic rates, paid them by the railroad and terminal companies, redcaps keep any tips which passengers give them over and above the regular charge for carrying baggage.

Most of the redcaps who are employed under union contracts work an 8-hour day. Often they are scheduled to work at irregular hours such as in the early morning or late afternoon when most of the trains are arriving and departing from their stations. Some companies furnish the uniforms worn by redcaps in their employ, while in other cases the companies pay part of the cost and the redcaps pay the rest.

Practically all redcaps are members of unions. They are represented primarily by the United Transport Service Employees, or by the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees.

Shop Trades

Nature of Work

The skilled workers employed by the railroads to build, maintain, and repair rolling stock and other equipment may be classified in six main "shop crafts:" *Carmen* (D.O.T. 5-79.020), machinists, electrical workers, sheet metal workers, boilermakers, and blacksmiths. They work in railway shops, engine houses, yards, and terminals.

In 1958, about 112,500 journeymen mechanics were employed by class I line-haul railways in these six crafts. Working with them were 6,600 gang foremen and leaders, 24,500 helpers, and 5,300 apprentices. Several thousand more workers in the same occupations were employed by short-line railways.

Carmen, who numbered about 58,100 on class I line-haul railroads in 1958, are by far the largest group of shop craftsmen. There is a great deal of variety in the kinds of work they are called on to do, since they build, maintain, and repair railroad freight and passenger cars, and also work on locomotives and on small vehicles such as the motor-driven cars used in transporting workers along the tracks. Most carmen are skilled in carpentry and can use power equipment as well as handtools. A few are skilled only in specialties such as upholstering, car painting, and patternmaking. Some carmen work as car inspectors in the railroad yards and stations, examining cars for defects that might lead to train accidents or delays.

Machinists are the second largest group of skilled shop workers. About 25,800 were employed by class I line-haul railroads in 1958, doing such work as assembling and dismantling equipment, and making and repairing parts. Electrical workers, about 16,000 of whom were employed, install and maintain wiring and electrical equipment on locomotives, passenger cars, and cabooses, as well as in buildings owned by the railroads. Sheet-metal workers, numbering about 7,600 in 1958, install and maintain light sheet-metal parts and do pipefitting on cars, locomotives, and other equipment. Boilermakers, of whom there were about 2,700, work mostly in locomotive shops where they maintain and repair locomotive and stationary boilers, fireboxes, tanks, and other parts made of sheet iron or heavy sheet steel. Blacksmiths, who numbered about 2,300, are employed to forge and fabricate parts such as springs and side rods for locomotives and other equipment. Other craftsmen employed in the shops include molders, stationary

Carmen, in repairing rolling stock, use pneumatic and electrical equipment to turn bits at high speed.

firemen, oilers, and stationary engineers (steam). (More information about the nature of the work of most of the above shop trades may be found elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

Apprenticeship is the usual way of entering the shop trades. Under standards which in many cases are included in agreements negotiated by the shopmen's trade unions and the railroad companies, apprentices are trained in all branches of their respective trades, and upon completion of their training, are certified as qualified journeymen. Beginners with no previous experience in their chosen trades take this training as regular apprentices, generally for a 4-year period. Men with at least 2 years of previous work experience in the trade train as helper apprentices for a 3-year period.

To become a regular apprentice, the applicant must be at least 16 and not over 21 years of age. The railroads prefer that helpers entering the 3-year apprentice training be no older than 30 or 35. On some roads, applicants for regular apprentice training are required to pass aptitude tests in mathematics and mechanics.

Workers in the shop trades may advance to supervisory positions as foremen in shops, enginehouses, and powerplants.

Employment Outlook

There will be several hundred opportunities for new workers to obtain jobs either as helpers or as apprentices in the shop crafts each year during the 1960's. In 1958, apprenticeship programs operated by class I line-haul railroads were training about 5,300 new workers, 4,500 of them as regular apprentices.

Openings in the skilled shop crafts will result primarily from the need to replace experienced craftsmen who retire, die, or transfer to other fields of work. The number of journeyman mechanics employed in these crafts declined from 163,000 in 1950 to 112,500 in 1958, and some further decline appears likely in the 1960's despite the fact that more rolling stock will be needed to handle the anticipated increase in freight traffic. Among the factors which are making it possible for the railroads to handle a given amount of work in the shops with a somewhat smaller workforce than formerly are the use of assembly line techniques in repair work, greater specialization of labor, and the use of better designed and constructed rolling stock.

Not all shop crafts have been affected in the same way by the changes in equipment and operating methods which are now under way in the railroad industry, nor are they likely to be affected in the same way in the future. The two extremes are represented by employment trends for electrical workers and for boilermakers. During the 1950–58 period, while the total number of skilled craftsmen in the 6 principal shop trades was decreasing by one-third, the number of electrical workers remained virtually unchanged. Some increase in employment of electrical workers is expected during the 1960's, because of the widespread use of diesel-electric power and the installation of more complex electrical and electronic equipment in locomotives and railroad cars. On the other hand, the decline that has already taken place in the number of boilermakers employed in the shops—from almost 10,000 in 1950 to 2,700 in 1958—is expected to continue because the skills of these workers are not required as much in the repair of diesel locomotives as in the repair of steam locomotives. In the case of carmen and machinists, who together account for three-fourths of all journeymen mechanics employed in the shop crafts, the decline since 1950 in the number employed has been in the neighborhood of one-third; some further decline, although probably less pronounced, is expected during the 1960's.

Earnings and Working Conditions

Average monthly earnings of journeymen employed by class I line-haul railroads in the shop trades in November 1958 were: Carmen \$430; machinists \$430; electrical workers \$445; sheet metal workers \$425; boilermakers \$420; and blacksmiths \$405. Helpers in all shop crafts averaged \$365 in the same month. Regular apprentices, who spend part of their time in classroom instruction and the rest of it on the job, averaged \$325; and helper-apprentices, who work on the same kind of basis, averaged $350. Gang foremen and gang leaders averaged $580. Most shop workers have a basic 40-hour workweek of five 8-hour days, and are paid time and one-half for overtime work.

Much of the work on railroad cars is done outdoors and workers are on the job in all kinds of weather. Major repairs on locomotives, however, are generally made indoors in the engine houses or locomotive shops.

Most shop workers are members of unions. Among the unions in this field are: Brotherhood Railway Carmen of America; International Association of Machinists; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers; and the International Brotherhood of Firemen and Oilers. In collective bargaining, these unions usually negotiate their labor contracts through the Railroad Employees' Department of the AFL–CIO.

Signal Department Workers

(D.O.T. 5–79.170 and 7–79.170)

Nature of Work

Workers in railroad signal departments are responsible for constructing, installing, maintaining, and repairing the signaling systems which control the movement of trains and assure the safety of railroad travel.

One group of skilled workers, known as signal maintainers, sees that wires, lights, switches, and other controlling devices are in good operating condition. The work requires a thorough practical knowledge of electricity and considerable mechanical skill. Work on the newer signaling systems also requires a knowledge of electronics.

A second skilled group, known as signalmen, generally has the same skills and knowledge required of maintainers, but is primarily concerned with constructing and installing new signals and signal systems. Signalmen work as members of crews which also include unskilled and semiskilled workers. The crews travel from one part of the road to another, wherever construction work is under way. In constructing a signal system, crews often build forms for concrete, mix and pour cement, weld metal, and do many other types of work in addition to electrical work.

In 1958, class I line-haul railroads employed 12,000 men in this kind of work; 8,500 were signalmen and signal maintainers, about 1,900 were semiskilled assistants, and 1,600 were unskilled helpers. Several hundred workers in these groups were also employed by the shortline railways and by switching and terminal companies.

Training, Other Qualifications, and Advancement

Railroads prefer that applicants for jobs as signal department workers be between 18 and 35 years of age and have a high school education or its equivalent. Knowledge of electricity and mechanical skill are assets to young men seeking these jobs.

New employees start as helpers doing unskilled work under the direction of experienced men. Helpers, after about 1 year of training on the job, usually advance to semiskilled work as assistants. Job openings for signalmen and signal maintainers are filled, as they occur, by promoting qualified assistants according to seniority rules. It generally takes at least 4 years for an assistant to work up to a position as signalman or signal maintainer.

Both signalmen and signal maintainers may be promoted to more responsible positions such as those of inspectors or testmen, gang foremen, leading signalmen, or leading signal maintainers. A few may advance to such jobs as assistant supervisors or signal engineers.

Employment Outlook

Unlike most other railroad occupations, the number of signal workers is expected to increase somewhat during the 1960's. In addition, several hundred job opportunities for new workers will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The number of signal workers employed by class I line-haul railroads dropped slightly between 1950, when there were almost 14,500, and

1958, when the total was about 12,000. However, the number is expected to increase during the 1960's. The increasing mechanization of railway signal systems and railroad yards should result in a growth in the number of electrical workers needed to install and maintain the new electrical and electronic equipment.

Earnings and Working Conditions

The average earnings of signalmen and signal maintainers employed by class I line-haul railroads in November 1958 were $445. Assistant signalmen and signal maintainers averaged $380 and helpers $340 in the same month. Signal workers have a basic 8-hour day and 5-day week, and are paid time and one-half for work beyond 8 hours a day.

Signal maintainers tend to have fairly steady work, because the amount of work required for maintaining railroad signal systems does not change greatly with variations in traffic or with the seasons. Signalmen and other crew members, particularly on some northern roads, may have less work during periods of especially bad weather. Workers in both of these occupations do most of their work out of doors, and maintainers must be prepared to make repairs regardless of the time of day or the weather conditions. Both maintainers and signalmen, in working on signaling devices, must often climb poles and work near high-tension electric wires and unguarded railroad tracks.

Signalmen and other crew members who work on construction and installation, frequently work away from their homes and, on these occasions, many railroads provide camp cars for living quarters while the men pay for their own food. Maintainers are generally able to live at home, since they maintain signals only over a limited stretch of track.

Most signal workers are members of the Brotherhood of Railroad Signalmen of America.

Track Workers

(D.O.T. 0–98.71, 7–23.121, 9–32.01, and 9–49.30)

Nature of Work

Trackmen and portable equipment operators construct, maintain, and repair railroad tracks and roadways. Many of them work in section gangs which patrol and maintain a limited section of the railroad's right-of-way. Some roads, instead of using section gangs, organize most of their track workers in larger gangs which operate over longer stretches of the right-of-way. Still other track workers are employed in "extra" gangs used largely for seasonal maintenance and repair work.

Either a member of the section gang or track workers operating special equipment such as "detector cars" make regular inspections of the right-of-way, looking for cracked rails, weak ties, washed-out ballast, and other track and roadway defects. Trackmen and portable equipment operators working in the gangs then make the necessary repairs, using handtools such as picks, shovels, and hammers, and power equipment such as multiple tie tampers, power wrenches, and ballast cleaners. More and more railroads are using roadway machines to do heavy maintenance-of-way work which was once done by trackmen using hand tools.

In 1958, an average of 92,000 track workers were employed by class I line-haul railroads. They included 68,500 trackmen working in gangs,

Track workers use roadway machines to speed replacing worn railroad ties.

6,600 portable equipment operators and helpers, and 16,900 gang foremen. Additional thousands of these workers were employed by the short-line railroads. The size of this maintenance-of-way work force varies considerably during the year because many construction and repair jobs are done in the summer months when the weather is best.

Training, Other Qualifications, and Advancement

Most track workers are trained on the job, and it takes about 2 years for a beginner to acquire the skills necessary to become an all-round trackman. Machine operating jobs in track maintenance work are assigned to qualified trackmen on the basis of seniority.

Most roads prefer workers between the ages of 21 and 45 for their track work forces. Men seeking work as trackmen must be able to read and write and do heavy work. Applicants are often required to take physical examinations. A high school education is desirable for workers who are seeking to advance to positions as portable equipment operators and gang foremen.

Trackmen and portable equipment operators with the necessary seniority and qualifications may advance to positions of gang foremen or assistant foremen. A qualified foreman may advance to a supervisory maintenance-of-way position such as track supervisor.

Employment Outlook

Several thousands of new workers will be hired each year in track maintenance occupations during the 1960's even though employment in this work is expected to decline. Particularly in northern sections of the country, most of these new workers will be taken on for the seasonal rush of work during the summer months. Comparatively few of the openings that occur will offer steady year-round employment.

For some years, mechanization and the use of new kinds of materials in roadway construction have been substantially reducing the number of men employed by the railroads in maintenance-of-way work. At the same time, however, the use of mechanized equipment has been creating a limited number of maintenance-of-way jobs involving the operation of roadway machines. Between 1950 and 1958, as the number of trackmen and foremen in section and other kinds of gangs dropped from 174,000 to 92,000, the number of portable equipment workers rose from 6,000 to about 6,600. These trends are expected to continue in the 1960's.

Earnings and Working Conditions

Track workers are among the lowest paid groups in the railroad industry. Men employed in section and other kinds of gangs on class I line-haul railroads earned an average of about $310 in November 1958. Portable equipment operators and helpers averaged $390 and gang foremen averaged $435 in the same month. A basic 5-day 40-hour week was in force for most classes of track workers. Time worked in excess of 8 hours a day was paid for at time and one-half rates.

Since most section men inspect and maintain only a few miles of track, they are usually able to live at home. Trackmen and portable equipment operators who work in other kinds of gangs often travel from place to place, however, and must live in camp cars or trailers, where they pay for their own food.

Most of these maintenance-of-way workers are members of the Brotherhood of Maintenance of Way Employees.

Bridge and Building Workers

Nature of Work

These workers construct, maintain, and repair tunnels, bridges, stations, railway shops, and a variety of other structures owned by the railroads. In 1958, class I line-haul railroads employed in this kind of work about 12,500 skilled craftsmen, 4,100 helpers, and 2,900 foremen. Among the skilled craftsmen were about 8,200 carpenters working as all-round mechanics in a variety of construction trades in addition to carpentry; about 2,500 masons, bricklayers, plasterers, and plumbers; and about 1,100 painters and 700 iron workers. The short-line railways employed several hundred more workers in the same occupations. (Information about the nature of the work done by these craftsmen can be found elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

New employees usually receive their training on the job as helpers. As openings occur in skilled mechanics' jobs, they are filled by helpers who have qualified for promotion and have the necessary seniority.

Journeymen with the necessary experience and ability may advance to positions as foremen, inspectors, or bridge and building supervisors.

Employment Outlook

A small number of job openings in the bridge and building work force will arise each year during the 1960's, even though the overall number of these workers may decline somewhat. Retirements, deaths, and transfers to other fields of work will provide some job opportunities for new workers. Most of the jobs available will be as beginners or helpers, where turnover rates are relatively high.

Employment by class I line-haul railroads of skilled craftsmen, helpers, and foremen on bridge and building work decreased from 29,500 in 1950 to 19,500 in 1958. This trend is expected to continue because the increased use of power tools and laborsaving equipment, and of new materials which require less maintenance and repair, will cut down further on the number of men needed for construction and maintenance work.

Earnings and Working Conditions

The average earnings of carpenters employed by class I line-haul railroads in bridge and building work in November 1958 were $365. Masons, bricklayers, plasterers, and plumbers averaged $410, iron workers $405, and painters $345 in the same month. Helpers averaged $325 and foremen $455. Bridge and building workers work a 5-day basic 40-hour week and are paid time and one-half for work beyond 8 hours a day.

Bridge and building men are often away from their homes for days at a time. On these occasions, they usually live in camp cars supplied by the railroads, but they pay for their own food.

The Brotherhood of Maintenance of Way Employees represents the bridge and building workers on most roads.

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RESTAURANT OCCUPATIONS

Millions of Americans have lunch in restaurants every working day or "eat out" while traveling or when away from home under other circumstances. In 1958, the total amount spent for food eaten outside the home exceeded $16 billion and represented approximately one-fourth of the Nation's total food bill.

The business of preparing and serving the vast amount of food consumed in public eating places requires a great number of workers. More than a million men and women were employed in 1958 in the approximately 200,000 separate establishments whose main business was to serve food. In addition, thousands of cooks, waiters, and other food service workers were employed in hotels, department stores, and other establishments which serve meals in connection with some other primary business. These figures exclude the many thousands of proprietors who participate in the management and operation of their own restaurants.

Nature and Location of the Restaurant Business

Establishments which cater to the American custom of "eating out" range from roadside diners to elegant and expensive restaurants. The kind of food offered and the way it is served depend primarily on the type of customer the restaurant seeks to attract. For example, in cafeterias and other restaurants where large numbers of workers eat lunch on workdays, rapid service and inexpensive meals are emphasized. On the other hand, in restaurants where the customers have more time and are willing to pay higher prices, expensive food is served in a formal and leisurely manner.

Most restaurants are small independent businesses—many of them operated by their owners with no paid help or with the aid of only one or two part-time workers. Less than 10 percent of the restaurants are run by proprietors who own more than one restaurant or by organizations that operate restaurant chains. However, this group includes some of the country's largest restaurants. Although the average eating place employs only about 5 workers, some large restaurants have 100 or more employees.

Restaurant employment is concentrated in large cities, but even the smallest community has its coffee shop, luncheonette, or roadside restaurant. The number of restaurant employees in each State is directly related to the population. In fact, if all States were ranked by number of restaurant workers, their order would be approximately the same as their rank by population.

Restaurant Occupations

Waiters and waitresses are the largest group of restaurant employees. In large eating places, they are usually supervised by captains, headwaiters or headwaitresses, or hostesses, who also may greet guests and escort them to tables.

Cooks and chefs, the next largest occupational group, help establish a restaurant's reputation through their cooking skill. They may be supervised by a head cook or chef, who may also prepare menus, create new dishes, assist in purchasing food, and in training new cooks.

Restaurants also employ a variety of other workers: Busboys and busgirls who clear tables and carry soiled dishes back to the kitchen; dishwashers, vegetable cleaners and peelers, and other kitchen helpers; and janitors and porters who dispose of trash and garbage, sweep and mop floors, and do other cleaning jobs. Many of these workers operate mechanical equipment, such as automatic dishwashers, vegetable slicers and peelers, and garbage disposal units, which eliminate much drudgery and physical exertion.

Managers, other than proprietors, comprise a small proportion of all restaurant employees. They are responsible for coordinating the purchase, preparation, and service of food, and other restaurant activities in order to insure efficient and profitable operations and, at the same time, satisfy their customers. Large restaurants usually employ assistant managers to help direct the entire restaurant operation or to take charge of a special area of work such as food purchasing.

Some clerical workers are also employed in restaurants. Cashiers, who receive payments from customers and make change for them, are the largest group. In addition, some large cafeterias employ food checkers, who itemize and total customers' orders, and many large restaurants have bookkeepers, stenographers, and typists, and other clerks. A few thousand specialized workers including musicians and other entertainers, dietitians, accountants, and personnel workers are also employed by restaurants.

The key occupational groups in restaurants—waiters and waitresses, cooks and chefs, and managers—are discussed in detail later in this chapter. Many of the clerical and professional occupations found in restaurants, as well as in other industries, are discussed elsewhere in the Handbook. (See index for page references.)

Employment Outlook

Thousands of openings in restaurant occupations are expected each year, continuing through the early 1960's. Although many new jobs will be created by the growth of the restaurant business, most openings will result from turnover. Turnover is always high among waitresses, primarily because of the large number of women who work only a short time and leave to take care of family responsibilities. Turnover will also remain high among kitchen helpers and in other relatively low-skilled jobs as long as workers find it easy to shift to other jobs. Therefore, most of the job openings will be for waiters and waitresses, and kitchen helpers—both because of high turnover rates and because these workers are among the largest groups of restaurant employees. In addition, employment opportunities are expected to be favorable for people who are skilled cooks and those who can qualify as restaurant managers. There will also be a number of openings in clerical jobs, such as cashier, bookkeeper, stenographer, and typist. The need for people trained for specialized positions, such as food manager and dietitian, is also expected to continue.

In the long run, the restaurant business will probably continue to expand, providing a steady increase in employment opportunities for restaurant workers. Some of the major factors which will contribute to growth in the restaurant business are rising population and income levels, more women working outside the home, increased leisure time owing to shorter workweeks, longer vacation periods, and a greater volume of travel. The Nation's long-range multibillion dollar program of highway construction will undoubtedly be a special stimulus to automobile travel and hence to the restaurant business.

On the other hand, certain other factors will tend to restrict the growth in restaurant employment. These include the increasing use of vending machines to dispense prepared food, the widespread use in restaurant kitchens of precut meats and precooked and frozen foods, and the installation of new and improved equipment, such as automatic dishwashers, vegetable cutting and peeling machines, and waste disposal units.

In the event of a sharp drop in business and employment in many industries, the applicants for restaurant jobs might well exceed the number of openings, since much of the work in eating places—waiting on tables, dishwashing, cleaning vegetables, and other jobs—can be done by persons with little or no experience or training. However, it should be noted that employment in the restaurant business increased even during the depressed 1930's.

Where To Go for More Information

Additional information on the restaurant business as a field of work may be obtained from State and local restaurant associations and from:

Educational Director, National Restaurant Association,
8 South Michigan Ave., Chicago 3, Ill.

Hotel and Restaurant Employees and Bartenders International Union,
525 Walnut St., Cincinnati 2, Ohio.

Additional information on training opportunities in the restaurant field, including a list of schools and colleges offering courses which train managers and other restaurant workers, may be obtained by writing to:

The National Council on Hotel and Restaurant Education,
777 14th St. NW., Washington 5, D.C.

Additional information on the restaurant business and its workers is available in:

Training Restaurant Sales Personnel, Federal Security Agency, Vocational Division Bulletin 222, Superintendent of Documents, Washington 25, D.C. Price 65 cents.

Establishing and Operating a Restaurant, U.S. Department of Commerce (Revised edition, 1957). Superintendent of Documents, Washington 25, D.C. Price 70 cents.

High school students may obtain information on training programs for cooks, bakers, managers, and other restaurant workers by writing to the local Director of Vocational Education, Superintendent of Schools in their community or the State Director of Vocational Education in the Department of Education in the State capital.

Waiters and Waitresses

(D.O.T. 2–27.01 through .12)

Nature of Work

Waiters and waitresses spend most of their time taking guests' orders, serving food and beverages, making out checks, and, sometimes, collecting payments. However, the kinds of service they give are largely determined by the type and size of the establishment in which they work. In diners, luncheonettes, and many other small restaurants, the emphasis is on quick service with a minimum of frills. Waiters and waitresses in such eating places may have to clear tables, carry soiled dishes to the kitchen, and clean equipment, in addition to serving food. Sometimes they combine counter service, cashiering, or other duties with waiting on tables. In many formal restaurants, waiters and waitresses serve food at a more leisurely pace and are expected to observe established rules of correct food service. They may advise guests on the choice of wine for each food course or answer questions about how the food is prepared. They are sometimes assisted by busboys or busgirls who carry used dishes to the kitchen, set tables, and perform other duties incidental to meal service. In large restaurants, waiters and waitresses may be supervised by captains, hostesses, headwaiters, or headwaitresses; in small eating places, they may work directly under the supervision of the owner or manager.

Where Employed

Most waiters and waitresses are employed in restaurants, luncheonettes, cafeterias, nightclubs, and other separate establishments which are primarily eating and drinking places. The next largest number work in hotels. Considerable numbers are employed in schools, hospitals, and other institutions; in retail stores; in private clubs; and in railroad dining cars. A few work on passenger ships, for catering businesses, and in other types of establishments.

Altogether, more than half a million people are employed as waiters and waitresses—more than in any other service occupation. (See chart 24, p. 262). Women far outnumber men in this occupation, but men are employed in many restaurants, especially the more formal and expensive ones.

Training and Other Qualifications

Although it is still possible to enter this occupation with little formal schooling, more and more employers prefer to hire beginners with at least 2 or 3 years of high school. Special courses for waiters and waitresses, given by vocational schools, restaurant associations, and individual hotels, are considered good preparation by most employers. Some restaurants hire inexperienced workers and give them a few weeks of on-the-job-training, often first as busboys or busgirls and later as waiters and waitresses. On the other hand, many restaurants—especially those with the more formal type of service—hire only experienced personnel.

Waiters and waitresses must be able to do the simple arithmetic needed to add food checks and make tax computations. They should speak Eng-

More than a half million women are employed as waitresses.

lish reasonably well, have a friendly manner, know how to put people at ease, and be neat and clean in their personal appearance. Health certificates are frequently required of waiters and waitresses to indicate that they are free from communicable diseases.

Experienced waiters or waitresses may transfer to jobs in better paying restaurants and advance to supervisory positions, such as headwaiter or hostess. Supervisory workers may sometimes advance to managerial positions.

Employment Outlook

Many employment opportunities for waiters and waitresses are expected to become available during the early 1960's. Most openings for beginning waitresses will probably continue to arise from turnover in the relatively low-price restaurants where the majority of women in this occupation are employed. Competition will remain keen for the better paying jobs in higher price restaurants. The rate of turnover in these jobs is relatively low. Moreover, since the better restaurants have high job standards, they usually prefer to hire experienced waiters. A considerable number of temporary jobs will become available each summer in resort hotel dining rooms and other eating places. College students and local workers are usually hired for these jobs.

Over the long run, most openings for waiters and waitresses will continue to arise from the need to replace those who leave the occupation. However, additional waiters and waitresses will be needed as the restaurant business expands owing to growth of population, rising individual incomes, the trend toward eating more meals away from home, and other factors. (See employment outlook statement at the beginning of this chapter.)

Earnings and Working Conditions

In general, waiters and waitresses are paid only a small wage, often regarded as little more than a token payment. Total earnings in this occupation depend not only on the wages received, but also on tips, which may comprise a high proportion of earnings. The amount received in tips varies considerably, depending on such factors as the skill of the worker; the size, type, and location of the eating place; and the general tipping habits of the community. Busboys and busgirls, who ordinarily do not receive tips, are often paid slightly higher wages than the waiters and waitresses they assist.

Data on union wage rates for waiters and waitresses are available for a relatively small number of union contracts in several large cities. Wages (exclusive of tips) for unionized waiters and waitresses ranged from about $6 a day in Chicago to about $10 a day in San Francisco in late 1958. Wages in many restaurants, particularly in smaller cities and towns, were considerably less.

Although many waiters and waitresses work 48 hours or more a week, some ordinarily work a 40-hour week. Split shifts—which involve working for several hours serving one meal, taking some time off, and then returning to serve the next meal—is a common working arrangement for many dining room employees. Many eating places furnish meals—either free or at a low cost—and may also provide uniforms. Although the modern dining room is a pleasant place in which to work, waiters and waitresses are on their feet for hours at a time and often have to carry heavy trays.

The principal union which organizes waiters and waitresses is the Hotel and Restaurant Employees and Bartenders International Union.

(See introductory statement for Where To Go For More Information.)

Cooks and Chefs

(D.O.T. 2–26)

Nature of Work

Cooks and chefs in restaurants are responsible for the preparation of food in large quantities. The cooking skills required and the kinds of dishes prepared depend on the size and type of restaurant. In large and exclusive restaurants, several cooks may be employed, each a specialist in preparing a particular type of food—soups, meats, vegetables, sauces, pastries, or ice cream. The head cook or chef supervises the staff of cooks and kitchen helpers and has overall responsibility for all food prepared. In addition, he helps train other cooks, estimates food consumption (in order to assist managers in making food purchases, and planning and pricing menus), creates new dishes, and decides on the size of food portions. On the other hand, in a small restaurant, one cook, perhaps assisted by one or two helpers, may prepare all the food. In inexpensive eating places, menus may have little variety and the work of cooks is likely to be standardized and involve the preparation of only a limited number of dishes. For example, "short order" cooks in inexpensive restaurants may prepare mainly ready-to-cook food—hamburgers, minute-steaks and french fries.

To assist cooks, many large restaurants employ pantrymen or salad makers who prepare and mix ingredients for salads, certain desserts, and some other types of food. The dishwashers and other kitchen helpers employed in most restaurants also perform a variety of duties incidental to food preparation. They may lift heavy loads of foodstuffs, peel potatoes and other vegetables, wash dishes, clean pots and pans, dispose of trash and garbage, and otherwise help to keep the kitchen clean and sanitary. In this work, they often use mechanical kitchen devices, such as vegetable cutters and peelers and large automatic machines, such as dishwashers.

Where Employed

More than 300,000 cooks, about half of them women, were employed in 1958 in establishments which were primarily eating places. In addition, about 40,000 cooks—the majority of whom are men—were employed in hotel kitchens. Many thousands of cooks were employed in institutions, such as hospitals and schools, and in department stores, private clubs, aboard ships, on railroad dining cars, and in other eating places. Chefs—many of them European trained—represented less than 1 percent of all cooks employed in the Nation's eating places. Chefs are usually employed in hotels and in expensive restaurants.

Training and Other Qualifications

Cooks generally learn their trade either by informal on-the-job training or, less often, by a more formal type of apprenticeship. To become a skilled cook requires years of experience.

Although there are no formal educational requirements for becoming a cook, employers are giving increasing consideration to applicants who have taken school courses in restaurant cooking. Such courses are offered in some public vocational schools, private trade schools, and a few colleges. In addition, specialized cooking courses are some-

PHOTOGRAPH BY U.S. DEPARTMENT OF LABOR

Cooks in restaurants must use large utensils to prepare food in great quantity.

times given by local restaurant association groups with advice and assistance from the National Restaurant Association. These programs are particularly valuable because a major portion of the student's time is spent in well equipped school kitchens and skill is acquired through actual practice cooking. Courses for cooks include study in the use and care of equipment; food standards (selection, preparation, and service of food and determining the size of servings); proper sanitation procedures—including the public health aspects of food handling; cooking methods, such as broiling and the use of steam; and in the preparation of special dishes, such as soups, salads, and garnishes, and such egg dishes as souffles and meringues.

Experienced cooks may advance to more responsible cooking jobs in the same place of employment or may transfer to better paying jobs in other restaurants, especially if they qualify as specialists in preparing certain types of food. Promotion from cook to executive chef or head cook may take as long as 15 to 20 years; however, less time may be required, depending on the educational background and other qualifications of the person involved and the situation in the particular restaurant. The job of head cook or chef is usually filled by a man in the better restaurants. In addition to being an expert cook, a chef must have supervisory ability and a thorough knowledge of all types of foodstuffs and kitchen equipment in order to organize and direct kitchen operations efficiently. Cooks in supervisory positions may sometimes advance to managerial positions.

Cleanliness, the ability to work under pressure during peak periods, physical stamina, and a keen sense of taste and of smell are among characteristics required for the jobs of cook and chef. Health certificates which indicate that cooks are free from communicable diseases are frequently required.

Employment Outlook

Well-qualified cooks are expected to be in strong demand throughout the 1960's. Although there is always keen competition for the best jobs, there will be many employment opportunities for well-trained cooks in hotels and the better type of restaurants. An even greater number of jobs will become available for experienced but less skilled cooks for other kinds of restaurants. Most of the openings in all types of eating places will arise from the need to replace cooks who retire, resign, or die. Turnover is highest in low-price restaurants where many women cooks are employed.

Only a small number of openings for top positions as chefs will be available each year. However, opportunities for American-trained cooks to become chefs are expected to show continued improvement. A relatively large proportion of head and executive chefs were at, or near, retirement age in 1958 and many employers were experiencing difficulty in replacing chefs, particularly since few were available from foreign countries —the traditional hiring source.

Opportunities will probably continue to be good for cooks and chefs in institutions and other places which maintain eating facilities—hospitals, schools, department stores, industrial establishments, passenger ships, and private clubs. Young people will have many opportunities for employment in kitchen helper jobs where they sometimes gain experience helpful in qualifying as cooks.

Women will continue to find many opportunities for employment in the occupation. Although men are preferred for cooking jobs in the higher price restaurants, the proportion of women employed as cooks has been increasing steadily. Moreover, a majority of the institutional cooking jobs in places such as hospitals and schools are held by women.

In the long run, employment of cooks and chefs is expected to increase with the growth of the restaurant industry and closely related businesses. (See introductory section of this chapter.)

Earnings and Working Conditions

Experienced cooks received weekly wages ranging from about $50 to $100 in 1958, according to reports from several large cities. Earnings of pantrymen, dishwashers, and other kitchen workers are considerably less than those of cooks. The highest pay is received by head cooks or chefs. Chefs generally earn from $5,000 to $15,000 annually, depending upon their training and experience. Some chefs whose reputations are well known receive more than $25,000 a year. As a rule, cooks' salaries are closely related to the type of eating place in which they are employed. For example, short-order cooks in low-price diners and luncheonettes generally earn less than cooks in medium-price or expensive restaurants, and cooks' earnings are usually highest in hotel restaurants.

Although some cooks and chefs work a 40-hour week, many regularly work 48 hours or more. Cooks and kitchen workers generally receive free or low-cost meals and, sometimes, are furnished uniforms that are needed on the job.

Modern kitchens in many hotels and in some other large restaurants are scientifically arranged, air-conditioned, and furnished with the latest equipment and laborsaving devices. On the other hand, in some of the smaller eating places, working conditions may be less desirable. The work hazards involved include the possibility of burns from steam or hot stoves and injuries from knives and broken glass or china. Furthermore, cooks and their helpers are frequently required to lift heavy supplies and utensils.

The principal union which organizes chefs, cooks, and other kitchen workers is the Hotel and Restaurant Employees and Bartenders International Union.

(See introductory statement for Where To Go for More Information.)

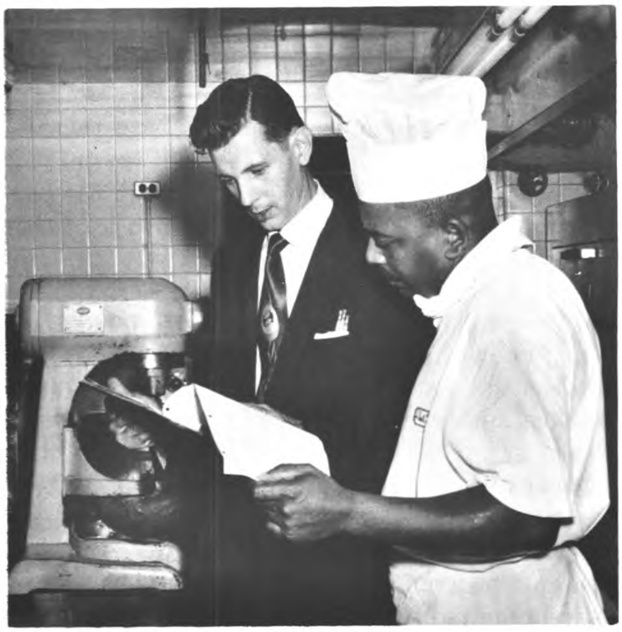
Restaurant Managers and Assistants

(D.O.T. 0–71.21 through .23)

Nature of Work

Restaurant managers have overall responsibility for the operation of establishments which serve food to the public. They coordinate and direct the work of cooks, chefs, kitchen helpers, waiters, waitresses, and other restaurant employees to insure that food is properly prepared and served. Managers also direct such activities as hiring and training personnel, purchasing food and kitchen equipment, keeping cost accounts, taking inventories, approving menus, and seeing that health and sanitation regulations are observed. In addition, their work usually involves frequent contacts with customers—to establish a friendly atmosphere, get their suggestions on food and service, or handle complaints.

In a large restaurant, the manager may have several assistants including a head cook or chef, headwaiter, and dietitian. An increasing number of very large restaurants employ specially trained assistants—often called food managers—to supervise the kitchen staff and be responsible for all food preparation. Many small restaurants are managed by their owners or by a paid assistant who may also help out on various jobs; for example, he may act as cashier and even take customers' orders during busy periods.



The manager is responsible for operating the restaurant smoothly and at a profit.

Where Employed

Between 75,000 and 100,000 managers (excluding proprietors) were employed in restaurants in 1958. In addition, thousands of managers were employed in dining rooms and other eating places in hotels, department stores, factories, schools, hospitals, private clubs, and other types of establishments.

Although opportunities for managers exist in cities and towns of all sizes, the greatest number of large restaurants and, therefore, most managerial positions are to be found in big cities. Some large eating places which employ managers are located in remote resort areas and on main highways.

Training and Other Qualifications

People usually become managers in one of two general ways. They may start in a job such as cook or waiter and work their way up, or they may enter directly as executive trainees. In either case, several years of experience in restaurant work are necessary to qualify as a manager, though persons with a good education may advance more rapidly than those without this background.

In a large restaurant, the promotion ladder for restaurant workers with kitchen experience may be from a minor supervisory position—such as pantry supervisor—to food manager, then to assistant manager, and later to restaurant manager; top administrative positions as executives in restaurant chains may also be attained. Similar advancement is possible for dining room workers who have a knowledge of kitchen operations. Experience in all aspects of restaurant work is important, since managers must be familiar with the duties performed and the equipment used by all the workers engaged in food preparation and service. They also must be able to apply their knowledge about food to such matters as purchase, storage, inventory, and cost control. Poise, self-confidence, and the ability to get along with people are desirable personal characteristics for restaurant managers.

Although no specific educational requirements exist for restaurant managers, participation in management training programs offered in vocational schools may be helpful in obtaining employment. Employers in the larger and more expensive establishments are showing an increasing preference for college graduates. The work-and-study programs offered by the few colleges which have specialized 4-year curriculums in institutional, restaurant, and hotel management are generally recognized as the best educational preparation. The curriculum usually includes preliminary and advanced courses in food preparation; specialized courses in restaurant accounting, catering, management, and sanitation; and more general courses, such as economics, law, marketing, and finance. Another requirement for a degree in these schools is three summers of work in restaurant or hotel jobs—ranging from busboy, food checker, and waiter to dining room captain and assistant restaurant manager. The valuable experience and contacts with employers thus obtained are often of assistance in obtaining desirable trainee or other restaurant positions after graduation. Individuals who enter restaurant work with this combination of education and experience are usually advanced to managerial positions within 5 years.

College graduates with less specialized training—especially those with degrees in business administration—may also be hired as executive trainees. They usually receive on-the-job training by rotating through all phases of restaurant work. Some trainees go through an industry-sponsored program of "executive apprenticeship" under which participating restaurants cooperate with the National Restaurant Association in preparing employees for management positions.

Employment Outlook

Opportunities for well-qualified people to become managers of restaurants and hotel dining rooms are expected to continue to be good during the early 1960's. New college graduates with training in food management will be in strong demand to fill jobs offering good possibilities of promotion. In addition, there will also be many opportunities for experienced restaurant employees with outstanding qualifications to move up through the ranks to managerial positions.

The largest proportion of openings will continue to arise from the need to replace managers who retire, resign, or die. However, a number of jobs will result from the establishment of new restaurants. In addition, some assistant manager jobs will become vacant as a result of promotions to top managerial posts. The expansion of existing dining facilities—especially in large hotels—will also create new positions for assistant managers. Students seeking on-the-job experience in restaurants will have good chances for employment, particularly in summer jobs in resort areas.

In the long run, a gradual increase in employment of managers is expected, as the restaurant business continues to expand. Opportunities will arise not only in establishments that serve food as their principal activity but also in institutions and other places where large numbers of people are served meals. The trend toward a greater number of chain restaurants will also provide an increasing number of managerial positions. The best opportunities will be for men with specialized education in food management who have the experience necessary to manage a large restaurant. There will also be many opportunities, in both the short and long run, for experienced people with business ability and the necessary capital, to establish and manage their own restaurants. However, operating one's own restaurant involves considerable risk of financial loss until the business is firmly established. (See introduction to this chapter for further information on employment outlook in the restaurant business.)

Earnings and Working Conditions

Beginning salaries were $3,600 a year or more in 1958 for management trainees who had graduated from one of the few 4-year colleges with specialized restaurant management programs (according to college administrators). College graduates with several years of restaurant experience generally earned between $6,000 and $10,000 annually in managerial positions in resturants and hotel dining rooms. Managers' salaries, which vary considerably by size and type of establishment, are generally highest in large or exclusive restaurants. In addition to salary, some restaurants give annual bonuses to their managers.

Salaried managers usually work 40 or 48 hours a week. People who own and manage their own restaurants often work longer hours. Generally, the evening hours worked by restaurant managers depend on the type of restaurant. For example, in city cafeterias which close shortly after most of the workers in nearby businesses have gone home, managers may have little or no evening work. On the other hand, in hotel and other restaurants which serve late dinners, managers work mainly in the evening. Managers usually receive free meals during the hours they are on duty. In large restaurants, managers may be covered by pension, insurance, hospitalization, and surgical plans.

Managers work in clean and, often, air-conditioned places. In large restaurants, they usually have their own office space. During mealtime periods, managers often walk about their establishments to check on the efficiency of operations. Managers in small establishments usually are on their feet for longer periods, since they have more direct supervision of kitchen and dining room workers than managers in larger restaurants.

(See introductory statement for Where To Go for More Information.)

TELEPHONE OCCUPATIONS

About 260 million telephone calls are made in the United States in an average day. Making connections for these calls, installing new equipment and keeping existing equipment in good working order, and performing the many functions necessary for running a large and complicated business required an average of more than 730,000 telephone company employees in 1958. The industry offers young persons many employment opportunities for steady, year-round work in a variety of jobs in communities throughout the Nation. Women comprise about three-fifths of the industry's work force.

Nature and Location of the Industry

Providing telephone service for the many millions of residential, commercial, and industrial customers is the main work of the Nation's telephone companies. In mid-1958, over 65 million telephones were in use in the United States. About 85 percent of the telephones are operated by the associated companies of the Bell System. The rest are operated by about 4,000 independent telephone companies. Although most of these companies are small and are located in rural areas, at least 1 company has affiliates in 34 States. Except in those few instances where lines of the independent companies do not tie in with those of the Bell System, telephone connections may be made between any two points in the Nation.

Telephone jobs are found in almost every community in the United States. However, most telephone workers are employed in metropolitan areas in which population and industrial and business establishments are concentrated. Over three-fifths of them have jobs in the 10 most heavily populated States: New York, California, Illinois, Pennsylvania, Ohio, Texas, Michigan, Massachusetts, New Jersey, and Missouri.

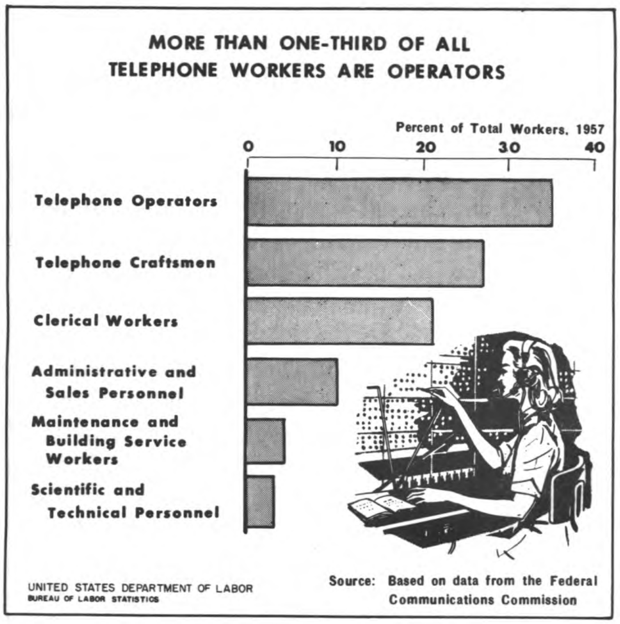
A brief description of how the telephone system operates may provide the reader a background for understanding the various jobs in the industry. The central office, containing the switchboard equipment through which any telephone may be connected with any other telephone, is the nerve center of the local telephone company. Each time a telephone call is made, it travels from the caller through telephone wires and cables to the cable vault in the basement of the central office. From the cable vault, thousands of pairs of wires fan out to a distributing frame where each set of wires is attached to either a switchboard or dial equipment. In order to join the caller's telephone to the telephone he is calling, connections are made on this frame manually by an operator or automatically by dial equipment. A long-distance call is routed from the local central office through cables to central offices in other cities.

In 1958, more than 250 million miles of wire were required to make connections among the many millions of telephones in operation. More than 97 percent of this wire was in the form of telephone cables which are made up of groups of individual wires. The largest cables may contain as many as 2,000 pairs of wires. In order to prevent damage to the wires, the cable is encased in lead or plastic covering. Much of this cable is strung on poles along with open wires. In large cities, most telephone cables are placed underground in conduits. Over long distances, such as from city to city, cable is frequently buried below the ground where it is safe from damage.

Some telephone users make and receive many calls which cannot be handled on a single telephone line. To take care of these calls, a system somewhat similar to a miniature central office may be installed on the subscriber's premises. This system is the private branch exchange (PBX) usually found in apartment houses, hotels, office buildings, and factories. Other special services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephones simultaneously, mobile radiotelephone units in automobiles, teletype machines in government or business offices, and telephones equipped to answer calls automatically and to give and take messages by recordings.

In addition to providing telephone service, the telephone industry is engaged in other communication activities. A vast network of cables and

CHART 49



radio-relay systems, built and maintained by the telephone industry, join the many thousands of television and radio stations all over the Nation. These services are sold to the networks and their affiliated stations. Telephone companies also operate teletype and private-wire services which they lease to business and government offices.

Telephone Occupations

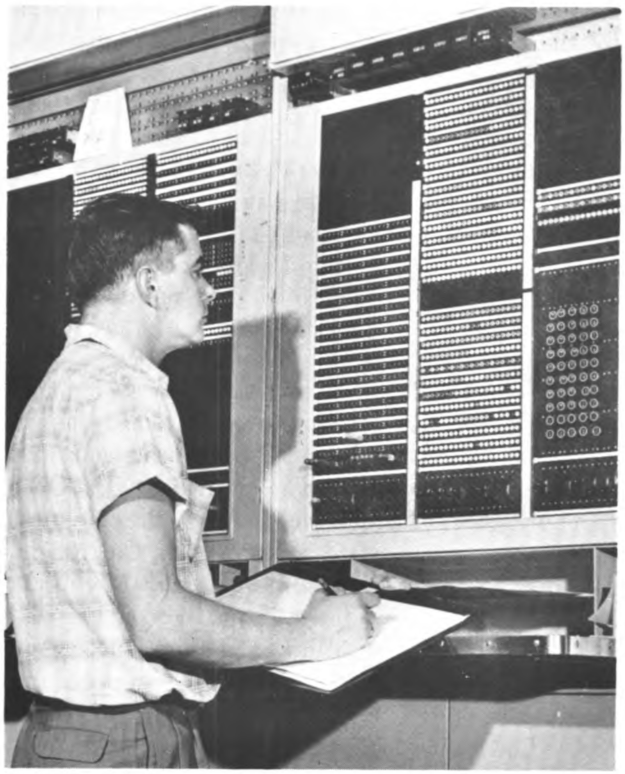
Keeping the telephone system operating requires a great many workers in many different occupations. Chart 49 shows the percentage distribution of employment by occupational group.

Telephone operators, the largest group of telephone employees, make up about 35 percent of the industry's employment. Operator jobs represent one of the largest fields of employment for women in the Nation's labor force. Their duties include making connections for callers by operating a switchboard, giving information, and performing many other services. Included among the telephone operators are women who hold such specialized jobs as service assistants, instructors, pay-station attendants, and long-distance operators.

More than a fourth of the telephone workers are engaged in installing, repairing, and maintaining the telephones, wires, cables, switchboards, and other types of communications equipment. These workers can be classified into three main groups: (1) The central office craftsmen who maintain and repair the equipment in central offices; (2) the line construction men who place, splice, and maintain telephone wires and cables; and (3) the installers who place, maintain, and repair telephones and private branch exchanges (PBX) in customers' homes, offices, and other places of business.

When complex new central office equipment is purchased by a telephone company, it is installed by central office equipment installers who are skilled workers employed by the manufacturers of this equipment. Though these men are not usually employed by the individual telephone companies, they are covered in this chapter of the Handbook because their jobs are so closely connected with the Nation's telephone system. (A discussion of these workers appears at the end of this chapter.)

To handle the tremendous amount of paper work involved in the daily business operations of the telephone system, the industry employs a great number of officeworkers. More than a fifth of



Central office repairmen record trouble spots as indicated on special panel boards.

all telephone workers are employed in clerical jobs, and most of these are held by women. Included are many stenographers, typists, bookkeepers, office machine operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. They keep records of the services rendered by the company, make up and send out bills to customers, and prepare a variety of statements and statistical reports. Some of this recordkeeping work is now being performed by electronic data-processing machines which have recently been introduced in some central offices. The use of this equipment has created new occupations in such fields as programming and computer console operating. (A discussion of these workers, as well as other clerical workers, appears elsewhere in this Handbook. See index.)

Almost 10 percent of telephone employment is made up of administrative and sales personnel. These employees include such specialized workers as accountants, attorneys, personnel officers, purchasing agents, tax agents, statisticians, and training specialists.

The telephone industry employs a considerable number of scientific and technical personnel including about 22,000 engineers, draftsmen, and engineering aids. These employees are engaged in planning, designing, and constructing new facilities and in solving the engineering problems that arise in the day-to-day operations of the telephone system. Other engineers are employed in sales development work. Many of the top supervisory and administrative jobs are held by persons with an engineering background. (A detailed discussion of the duties, training, and employment opportunities in the engineering field appears elsewhere in this Handbook. See index.)

About 4 percent of the telephone industry's workers are engaged in maintaining buildings, offices, and warehouses; in operating and servicing motor vehicles; and in other service jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other maintenance and custodial workers employed by the telephone industry are janitors, porters, watchmen, elevator operators, and guards. The duties, training and other qualifications, employment outlook, and earnings of the principal telephone occupations—central office repairmen, linemen and cable splicers, installers, and telephone operators—are discussed at the end of this chapter.

Employment Outlook

Many thousands of new workers will be hired by telephone companies during the 1960's. Most job openings will arise as a result of replacement needs. The growth of the industry will also provide a considerable number of openings. Although total employment will increase, there will be variations in the rate of growth of different job groups.

Since 1877, when telephones were first used on a commercial basis, the industry has grown rapidly. The number of telephones in use grew from 1 million in 1900 to over 65 million in mid-1958. The greatest expansion occurred in the post-World War II period when the number of telephones in use more than doubled. Employment also has expanded since the beginning of the century but at a much slower rate because of increased mechanization and other technological changes in the industry. Employment had its sharpest gain in the postwar period when a huge expansion program was carried out by the industry. Between 1946 and 1958, the number of workers rose from more than a half million to almost three-quarters of a million.

During the 1960's, it is expected that the number of telephones in use will continue to increase steadily—at an annual rate of about 5 percent. This expansion will result partly from the increase in population and number of family units as well as the growing number of business and industrial establishments. The 11 million households in the United States still without telephones will be another important factor in the demand for increased services. Other indications of future expansion include the trend toward using more than one telephone in private homes; the widespread installation of outdoor public telephone booths; and the increasing demand for special equipment, such as telephones in different colors, dials that are visible in the dark, and volume controls to compensate for impaired hearing.

Employment in the telephone industry is also expected to grow—but at a much slower rate than the number of telephones in use. As in the past, the industry will be able to provide an increasing volume of service per employee as a result of continued technological improvements. Both the expansion of the industry and technological changes will affect differently the employment outlook of the various occupational groups.

Although the continued expansion of telephone service will create some openings for telephone workers, replacement needs will be the major source of job opportunities resulting in thousands of job openings each year. Most openings for telephone operator jobs and for some office jobs will result from a relatively high turnover rate for these workers. A large proportion of these jobs are filled by young women, many of whom stop work when they marry. Other women who are married quit work to raise a family.

Earnings and Working Conditions

Earnings of nonsupervisory employees in telephone companies averaged $81.90 a week or $2.14 an hour for a 38.3-hour week in April 1959, according to the Bureau of Labor Statistics. Pay rates and progression from the minimum or starting rates are usually governed by well-defined schedules set forth in labor-management agreements. These schedules stipulate the amount of time required to move from one step to another as well as the weekly wage increase accompanying each step upward. Usually, pay increases in most telephone jobs are given every 3 or 4 months for the first year or two and then every 6 months until the top of the grade is reached in 5 or 6 years.

Generally, telephone companies' union contracts call for premium pay for work performed in excess of 8 hours a day or 40 hours a week and for all Sunday work. Most contracts also provide that the rate of pay for nightwork shall be 5 or 10 percent above the basic day rate. Overtime work is sometimes required in the telephone industry especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency callout," which is a short-notice request to report to work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at his basic hourly rate, and travel time to and from the job is counted as worktime.

In addition to these provisions which affect the pay envelope directly, other benefits are provided by the telephone companies. Periods of annual vacations with pay are granted to workers according to length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 15 years, and 3 weeks for over 15 years of service. The number of paid holidays varies from 6 to 11 days a year depending on locality. Nearly all companies have sick leave provisions for their employees. A typical program provides that payments for sick leave up to 7 days be paid to employees with at least 2 years of service. Provisions for sick leave beyond 7 days are covered in benefit plans adopted by most companies. The majority of the telephone workers are covered by group insurance plans which usually include sickness and accident insurance and retirement and disability pensions.

The telephone industry has achieved one of the best safety records in American industry. The injury-frequency rate in the telephone industry was the lowest among all the industries surveyed in 1957 by the Bureau of Labor Statistics. For each million man-hours worked in the industry in that year, less than one disabling injury occurred. For all manufacturing, the injury-frequency rate was 11.4.

Where To Go for More Information

Additional information about jobs in the telephone industry can be obtained from the local telephone company or from local unions with telephone workers among their membership. If no local union is listed in the telephone directory, information may be obtained from the following:

Communication Workers of America,
1808 Adams Mill Rd. NW., Washington 9, D.C.

International Brotherhood of Electrical Workers,
1200 15th St. NW., Washington 5, D.C.

Central Office Craftsmen

Nature of Work

The telephone companies in 1958 employed about 66,000 central office craftsmen and their foremen to test, maintain, and repair the manual and dial central office equipment. The central office craftsmen group is composed of several occupations with different skill levels. These occupations are described below.

One of the primary duties of central office craftsmen is preventive maintenance; that is, to locate and eliminate potential trouble spots before they become serious enough to interfere with service. Periodic tests are made on all central office equipment to keep it in good operating condition. Another important function of some central office craftsmen is to help locate and analyze trouble spots on customers' lines by using special testing equipment located in the central offices.

Frameman (D.O.T. 7-53.020) is usually the beginning job from which a worker may advance to the more skilled central office crafts jobs. Framemen do most of their work at the distributing frames or panels where thousands of pairs of wires come in from lines and cables. In large central offices, these frames may be as large as two stories high and a half block long. Framemen string wires to the proper terminals on the frames and then solder the connections. This work requires some manual dexterity in making connections with small wires. Connections are made according to worksheets prepared by other specialized personnel or by oral directions of the testboardmen.

Central office repairmen (D.O.T. 5-53.235), often called "switchmen," maintain and repair the switching equipment in the central office. These repairmen check the apparatus, switches, and relays, using special tools and gages and their knowledge of circuit operations. They make repairs and precision adjustments as necessary. They also locate and repair trouble spots which are reported to them by the testboardmen. Central office repairmen are sometimes designated according to the type of central office equipment they repair, such as *manual equipment repairmen* or *dial office switchmen.* In 1958, the telephone industry employed over 39,000 central office repairmen, helpers, and framemen.

Testboardmen (D.O.T. 5-53.310) help keep telephone services operating efficiently by testing for and analyzing trouble spots reported on customers' lines. Working at special switchboards made up of electrical testing instruments, these workers determine the cause and location of the reported trouble. They then report the nature of the breakdown to the line and cable maintenance crews if the trouble is outside the central office or to repairmen within the central office who then make repairs to restore service. Testboardmen also make periodic routine checks of lines and circuits to prevent breakdowns. In 1958, more than 16,000 testboardmen were working in telephone companies.

Powermen (D.O.T. 5-51.510) operate and maintain the motors, storage batteries, and other equipment needed to provide electrical power in central offices. Only a few powermen are required even in large central offices. In small plants, their duties may be assigned to a central office repairman.

Training, Other Qualifications, and Advancement

Telephone companies usually hire young, inexperienced men to train for the skilled jobs in central offices. Applicants for these jobs generally must have at least a high school education or its equivalent. A knowledge of the basic principles of electricity is helpful. Preemployment tests are usually given to help select prospective employees. Training and experience received in the armed services may be helpful to veterans in obtaining jobs as telephone company craftsmen.

Most telephone companies have regular programs for training new employees in central office jobs. These programs include classroom instruction as well as on-the-job training. After a training course of a few weeks, a new worker in the central office is assigned to a starting job. He usually begins as a frameman where he works alongside the skilled craftsmen under the direction of a supervisor or foreman. As the frameman gains skill and experience, he may advance to a job as central office repairman. A person

Framemen connect the thousands of pairs of wire that come into the central office from lines and cables.

assigned to this job generally receives additional classroom instruction lasting 6 weeks or longer. Instruction includes such courses as the principles of electricity and magnetism, as well as special courses on the maintenance of the particular type of central office equipment used by the company. Central office repairmen may be promoted to the job of testboardmen. In some cases, employees move directly from framemen to testboardmen. Normally, it takes at least 6 years from the time workers are first employed to reach the top step in the progression schedule as central office repairmen or as testboardmen.

Central office craftsmen receive training throughout their careers with the telephone company. As new types of equipment and new maintenance procedures are developed, these men may be sent to school for short periods of instruction. Many workers move into central office jobs from other types of telephone jobs. For example, some men start out as telephone installers or as linemen and eventually transfer to jobs as central office craftsmen with additional training.

Employment Outlook

Young men will find many opportunities for employment in central offices of telephone companies in the 1960's. Many of these openings will arise from the expected expansion of telephone facilities and the growing complexity of central office equipment. (See p. 701 for a discussion of the long-run outlook for the demand for telephone services.) The wider use of the dial system along with the conversion of more central offices to the automatic message accounting system will greatly increase the amount of new central office equipment in use. Many additional central office craftsmen will be needed to install, test, maintain, and repair this equipment. It is expected that central office craftsmen will be one of the faster growing groups of telephone employees. Job openings will also result from the need to replace those workers who retire, die, or leave the industry to take other jobs. Retirements and deaths alone are expected to create 10,000 job openings in the 1960–70 decade.

Earnings and Working Conditions

Central office craftsmen are the highest paid group of skilled workers in the telephone industry. In October 1958, average earnings of testboardmen in large telephone companies in the United States was $2.69 an hour, and $2.56 for central office repairmen. By region, average earnings of testboardmen ranged from $2.61 an hour to $2.95; for central office repairmen, they ranged from $2.41 to $2.69.

Earnings vary considerably with length of service in central office jobs. According to the 1958 wage schedule of a telephone company in one of the higher pay scale cities, framemen start out at a basic weekly rate of $57.50 and can work up to a maximum of $100.50 after 5 years. At any time during this period, if a vacancy occurs and the worker is qualified, a frameman may move into the job of central office repairman or testboardman on a higher pay schedule. Central office repairmen and testboardmen can reach a maximum of $119.50 after 6 years of periodic increases.

Since the telephone industry gives continuous service to its customers, the operation of a central office is a 24-hour, 7-day-a-week job. Therefore, some central office craftsmen work schedules which include evenings, nights, and weekends. Employees in central offices work under comparatively favorable conditions in clean and well-lighted surroundings. Central office craftsmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 702.)

Linemen and Cable Splicers

Nature of Work

The vast network of wires and cables which connects telephone central offices to the millions of telephones and switchboards in customers' homes and buildings is constructed and kept in good operating order by linemen and cable splicers and their helpers. In 1958, telephone companies employed about 20,000 linemen and 17,000 cable splicers. Almost 7,000 foremen and 9,000 cable splicers' helpers and laborers were also employed in these operations.

Linemen (D.O.T. 5-53.410) place wires and cables and perform all the other tasks necessary for constructing new telephone lines and maintaining and repairing existing lines. In new line construction, they dig holes in the ground, place and tamp in telephone poles, and attach crossarms and other fixtures that support the wires and cables. Linemen climb poles and raise and attach the wires to insulators on the poles. They place cables on the poles, leaving the cable ends free for cable splicers to connect later. In urban areas, they may also place cables in underground conduits. Linemen usually work in line construction crews of 2 to 5 men. A foreman directs the work of several of these crews.

Although the installation of new telephone lines is an important aspect of the job, much of the linemen's work includes repairing and maintaining existing lines. Linemen are sometimes assigned certain sections of lines which they inspect periodically. During the course of their work, they make minor repairs and line changes. When wires or cables break or when a pole is knocked down, linemen are sent immediately to make emergency repairs. The line crew foreman keeps in close contact with the testboardman who directs him to trouble spots on the lines.

Cable splicers (D.O.T. 5-53.950), after linemen place wires and cables on poles or in underground conduits, complete the line connections. Splicers work an aerial platforms, in manholes, or in basements of large commercial buildings. They perform the delicate task of linking each individual wire within the cable by matching colors of pairs of wires in such a way as to keep each circuit continuous. Cable splicers also rearrange pairs of wires within a cable whenever the lines have to be changed. At each splice location, they wrap insulation around the wires and seal the joint with a lead sleeve or other type of closure. Occasionally, they fill the sheathing with inert gas under pressure to keep moisture out. Splicing is a very responsible and exacting job; an incorrectly spliced cable can lead to a serious breakdown in telephone service for the subscribers on the line.

Lineman on pole secures wire with a metal strap.

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In addition to connecting new cable, cable splicers also maintain and repair cables. Preventive maintenance is extremely important because a single defect in a cable may result in a serious interruption in service. Many trouble spots can be determined through electrical and gas pressure tests and measurements made from the central office testboard.

Training, Other Qualifications, and Advancement

Telephone companies hire young, inexperienced men to train for jobs as linemen or cable splicers. New employees for these skilled line and cable jobs usually must have a high school education or its equivalent. Knowledge of the basic principles of electricity is also helpful, though not a prerequisite. Preemployment tests are often given to help determine the applicant's aptitudes. Some of the line and cable work is strenuous, requiring the climbing of poles and the lifting of lines and equipment. Telephone companies look for young men with agility, good physical condition, and manual dexterity. Manual dexterity and the ability to distinguish color are particularly important qualifications for this work. Many young persons who have received telephone training and experience in the armed services are given preference for job openings and are brought in above the entry level.

Telephone companies have established comprehensive training programs for these jobs. New workers are given classroom instruction in addition to on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, crossarms, and other fixtures, to simulate working conditions as much as possible. Trainees learn to climb poles and are taught safe working practices to avoid the hazards of power wires and falls. After a short period of this training, the new lineman is assigned to a line crew and goes out in the field to work with experienced men. He continues to learn while on the job under the supervision of the line foreman. It usually takes about 6 years for the lineman to reach the top of the pay schedule.

In other cases, new men are first assigned as cable splicers' helpers. Working with experienced cable splicers under the direction of a splicing foreman, they gradually acquire all the skills of the trade. After working 3 or 4 years as a cable splicer's helper, a man may advance to cable splicer and may reach top pay for the job in another 2 or 3 years.

Line construction craftsmen continue to receive training throughout their careers with the telephone company in order to qualify for more difficult assignments and to keep up with technological changes in the industry. Cross-training (switching workers from one job to another) provides additional advancement opportunities for workers in the telephone industry. For example, after a few years of working as a lineman, a man may be transferred to the job of central office repairman or to telephone installer and later to telephone repairman. The amount of such shifting depends on the needs of the company and the aptitude of the workers.

Employment Outlook

Employment of linemen and cable splicers is expected to increase moderately during the 1960's. Replacement needs, however, will provide most of the job openings for new workers.

In order to meet the pent-up demand for new telephone services which had accumulated during World War II, telephone companies more than doubled their employment of linemen and cable splicers from 1945 to 1948. Since 1949, there has been only a small growth of employment in these occupations. The anticipated expansions in line construction will result in only a small increase in employment of these workers.

Because of the strenuous nature of the work, some linemen are unable to continue in the occupation after they reach 50 or 55 years of age. Those linemen who have not already been transferred to other crafts jobs by the time they reach their fifties are usually transferred to some less physically demanding job. Replacement needs resulting from transfers to other jobs, retirements, or deaths are expected to create about 10,000 openings during the 1960–70 decade.

Earnings and Working Conditions

Cable splicers have higher wage rates than linemen. In October 1958, cable splicers, in the United States as a whole, averaged $2.64 an hour, linemen averaged $2.18, and cable splicers' helpers averaged $1.78. By region, average hourly earnings of cable splicers ranged from $2.31 to $2.80; for linemen, they ranged from $1.86 to $2.34; and for cable splicers' helpers, from $1.73 to $1.90.

Pay rates within the jobs also depend to a considerable extent upon length of service. For example, new workers in line construction jobs at a telephone company in one of the higher pay scale cities, in 1958 began at the basic weekly rate of $57.50. Linemen could reach the maximum of $112.50 after 6 years of service. Cable splicers' helpers could reach a maximum of $89.50 in less than 4 years of service. (However, at some time before reaching this maximum, many helpers are reclassified as cable splicers and are thus transferred to a new pay schedule.) The maximum basic weekly rate of cable splicers was $119.50, based upon a combined total of at least 6 years' work as a helper and as a splicer. Linemen and cable splicers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 702.)

Linemen and cable splicers work outdoors in all kinds of weather. They must do a considerable amount of climbing. In cities, where underground cable is used, cable splicers also work in manholes under the streets. Here, considerable stooping and working in cramped positions are involved. Safety standards developed over the years by the telephone systems with the cooperation of the unions have greatly reduced the hazards of these occupations. When severe weather conditions damage telephone lines, both linemen and cable splicers may be called upon to work long and irregular hours to repair damaged equipment and to restore service.

Telephone and PBX Installers and Repairmen

Nature of Work

Telephone and PBX installers and repairmen install and service telephone and private branch exchange (PBX) systems on the customers' property and make necessary repairs on the equipment when trouble develops. These workers travel to customers' homes and offices, often driving trucks equipped with telephone tools and supplies. When telephone customers move or request new types of service and equipment, installers relocate or make changes or additions to customers' existing equipment. For example, they may install a multiline key telephone system in a business firm or change a 2-party line to a single-party line in a residence. Installers may also answer a customer's request to add an extension in another room of a residence or to replace an old telephone with one of the newer models.

In 1958, there were almost 79,000 telephone and PBX installers and repairmen, making this the largest group of telephone craftsmen. Over two-thirds of these men were engaged primarily in installing telephones or private branch exchanges. More than 15,000 were engaged in repairing and maintaining this equipment, and about 10,000 were foremen. Although the jobs of installing and repairing telephones and PBX systems are discussed below as separate jobs, many telephone companies combine two or more of these jobs.

Telephone installers (D.O.T. 5–53.030) install and remove telephones in homes and places of business, including coin-box telephones, switching equipment, and the associated inside wiring. They connect newly installed telephones with outside service wires which they run to nearby cable terminals on buildings or poles. Installers must often climb poles in order to make these connections. Telephone installers are sometimes called *station installers*.

PBX installers (D.O.T. 5–53.020) are workers who perform essentially the same duties as telephone installers, but they specialize in more complex switchboard installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers set up equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters.

Telephone repairmen (D.O.T. 5–53.240), with the assistance of testboardmen in the central office, locate trouble on customers' telephones, associated inside wiring, and outside service wires, and make the necessary repairs. Sometimes the jobs of telephone repairmen and telephone installers are combined and the workers are called *telephone installer-repairmen.*

PBX repairmen (D.O.T. 5–53.240), with the assistance of testboardmen, locate trouble on customers' PBX systems. Repairmen then make the necessary repairs at PBX telephone switchboards and maintain associated equipment, such as batteries, relays, and power plants. Some PBX repairmen maintain equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters. They may also service other electrical signal systems, such as buzzer signals, public-address systems, and automatic-calling systems. Sometimes the jobs of PBX installers and PBX repairmen are combined into the job of *PBX installer-repairmen.*

Training, Other Qualifications, and Advancement

Telephone companies hire young, inexperienced men and train them for telephone and PBX installation and repair jobs as they do for other craft jobs. Since much of the work requires dealing with customers, personal appearance and the ability to meet people are important considerations for these jobs. Applicants for these skilled jobs usually must have a high school education or its equivalent. To help determine the applicants' aptitudes, preemployment tests are sometimes given.

New entrants are given classroom instruction in addition to on-the-job training. Classrooms are equipped with actual telephone apparatus to simulate working conditions as much as possible. For example, in the rooms assigned to installation training, telephone poles, cables, and terminal boxes as well as typical examples of home and office installations are set up just as they appear in the field. After a few weeks of classroom training, new workers accompany skilled installers and learn the job by watching and helping the experienced men. It normally takes from about 3 months to a year of experience before new workers are ready to perform installation work alone.

Telephone and PBX installers and repairmen continue to receive training throughout their careers with the telephone company in order to qualify for more difficult and responsible assignments. Since technological changes in the telephone industry are occurring constantly, it is the practice of telephone companies to send their craftsmen to training schools from time to time for further instruction. Cross-training (switching workers from one job to another) provides additional advancement opportunities for workers in this industry. For example, after a few years of working as a telephone installer, a man may be transferred to the higher paying job of PBX installer. Similarly, a telephone repairman may be promoted to PBX repairman, one of the top paying jobs. In another case, a new worker may start out as a lineman and then be transferred to the job of installing and repairing telephones, later moving to either PBX installer or PBX repairman.

Employment Outlook

Employment of telephone and PBX installers and repairmen is expected to continue to increase steadily during the 1960's. In this period, the number of telephones in use is expected to grow at an annual rate of about 5 percent a year. As the number of telephones in use increases, more installers and repairmen will be needed. They will be employed not only to install new telephones, but, more importantly, to service and repair existing equipment and to disconnect and hook up telephones when customers move from one place to another. This last factor has been particularly significant in recent years because of the larger number of persons and businesses moving each year. For example, in April 1958, one out of every five persons in the United States was living in a different house from the one he lived in 1 year earlier.

In addition to job openings arising from the growth of these occupations, replacement needs due to promotions, retirements, deaths, and transfers to other fields of work will also provide many job opportunities for new workers. Although a large proportion of telephone and PBX installers and repairmen are young men who were hired since World War II, there are also older men in these occupations nearing the retirement age. It is estimated that retirement and death alone will create more than 10,000 job openings in the 1960–70 decade.

Earnings and Working Conditions

In October 1958, PBX repairmen earned an average of $2.77 an hour and telephone and PBX installers earned $2.56. By region, average hourly earnings for PBX repairmen ranged from $2.04 to $2.89, for telephone and PBX installers, they ranged from $1.81 to $2.67

Telephone companies have pay schedules in which the wage rates within each job classification increase with length of service. For example, in the 1958 wage schedule of one of the higher pay scale cities, telephone installers and repairmen started with a basic weekly wage of $57.50 and received periodic pay increases until they reached a maximum of $114.50 after at least 6 years. PBX installers and repairmen began with the same base pay and progressed to $119.50. Installers and repairmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 702.)

Telephone and PBX installers and repairmen work indoors and outdoors in all kinds of weather. Outdoor work includes placing and repairing wires leading from telephone poles to customers' premises. Climbing poles is a necessary part of the installers' job. The work of installers and repairmen brings them in contact with the public since they work in the customers' homes and places of business. These workers are subject to emergency callouts in case of breakdowns in customers' lines or equipment.

Telephone Operators

(D.O.T. 1–42.00 through 1–42.09)

Nature of Work

Telephone operators make up the largest group of workers in the telephone industry. The job of the telephone operator is one of the larger fields of work for women. Telephone companies employed more than a quarter million women in various telephone operating jobs in 1958. The principal duty of most operators is to make connections for calls by placing plugs in the proper jacks or "receptacles" on switchboards, and to provide information or assistance to customers or other operators. There are a number of specialized operating jobs. Among such jobs are *long-distance operators* who assist callers in completing long-distance calls. They make connections necessary to reach distant points and record necessary data about the calls. *Information operators* service customers' and long-distance operators' requests for telephone numbers by referring to indexes, bulletins, or files which list subscribers by name and by address. *Dial-service assistance operators* provide special services to customers in dial offices by assisting them in placing and completing their calls.

Operators generally work in small groups of 15 or less led by a service assistant. The *service assistant* coordinates the activities on her section of the switchboard, checks operators in and out of their positions according to schedules, and assists operators with unusual or emergency calls. She conducts initial training classes, continues follow-up training of newly assigned operators,

Long-distance operators make calls to telephones in distant cities without help from other operators along the way.

and observes and checks the work of the operators.

The *chief operator* is responsible for planning and directing the activities involved in the operation of switchboards. She oversees personnel matters, such as hiring, training, and transferring of employees. She is assisted in her work by *assistant chief operators* and *central office clerks.*

Training, Other Qualifications, and Advancement

High school graduates between the ages of 18 and 25 are usually preferred for operators' jobs. Good eyesight and good hearing are always required and are carefully checked during the physical examination. In addition, the applicant is usually given a spelling, arithmetic, and learning ability test. A pleasing voice, alertness, manual dexterity, legible penmanship, a sense of teamwork for cooperating with other operators, and a stable disposition are the main personal qualifications for the job of operator.

A group of 2 or 3 new employees is generally assigned to an instructor (usually the service assistant) who teaches them on an individual basis for a period of 2 to 5 weeks. Training consists of discussions of procedures, handling controlled practice calls, and drills. With coaching and close supervision, the trainee practices handling the most common types of calls on dummy switchboards to develop skill and speed. After learning the fundamentals of common types of calls through this type of training, she is assigned to a regular position at the switchboard.

Further training and instruction are given to the operator periodically so that she may develop maximum skill in handling other switchboard positions. The service assistant continues to coach her in special procedures in the different switchboard positions, such as long-distance, information, and other operating services. The general policy of telephone companies is to have a flexible force of operators capable of working at a number of positions in the central office. To build up a force of all-round operators, cross-training on different kinds of work is necessary. Changes in the methods of handling calls and installations of new central office equipment make it necessary for operators to receive additional training throughout their careers.

A switchboard operator may be promoted to the job of service assistant which requires a thorough knowledge of all operating practices and the ability to instruct, check, and work harmoniously with her group. In most large central offices, the job of assistant chief operator is the next step in advancement for a service assistant. The job of chief operator is usually the highest level to which a telephone operator may advance within a central office.

Other jobs to which an experienced operator may advance are the clerical jobs in the central office or in the traffic department's administrative office. These clerical jobs are usually filled by recruiting from the operating staff since the knowledge of operating procedures is useful in this work. Central office clerks assist the chief operator in her clerical duties, and administrative clerks prepare reports for managing and planning the work of the traffic department. One job in the administrative office to which a service assistant or a service observer may advance is that of the PBX instructor. She insures good service on customers' PBX boards by teaching the customers' employees how to operate their PBX boards most efficiently. Frequently, qualified operators have opportunities to transfer to jobs in other departments, as, for example, to service representative in the business office.

Employment Outlook

There will be a great many opportunities for young women to enter this occupation during the 1960's, although relatively little change in the total number of telephone operators is expected. New employees will be hired primarily to fill jobs resulting from the high rate of turnover. A large proportion of these jobs are filled by young women who remain in the industry for only a few years. It is estimated that from 1950 to 1957, the telephone industry hired an average of 100,000 new operator trainees each year, primarily to fill the jobs of operators who had left their employ. Large numbers will be needed each year during the next decade.

Since World War II, a tremendous quantity of telephone equipment has been installed in telephone central offices. During the same period, the number of telephones in use nearly doubled. Despite this rapid expansion of telephone service, the number of employed operators remained at a fairly stable level of a quarter of a million. It is estimated that the number of new telephones in use will increase at a rate of about 5 percent a year during the 1960–70 decade. Following past trends, continued technological advances will enable the industry to handle the increased amount of service with little change in the number of operators employed.

Among technological developments affecting the employment of telephone operators are the extension of local dial systems to long-distance dial service, the conversion of the remaining manual local systems to dial service, and the increased use of automatic timing and recording devices. However, it must be emphasized that even with automatic telephone procedures, large numbers of operators will still be needed. Many types of calls, such as information calls, some calls from coin telephones, person-to-person calls, and reverse-charge calls, cannot be handled without the assistance of an operator.

Earnings and Working Conditions

In October 1958, major telephone companies in the United States paid an average of $2.68 an hour to chief telephone operators, $2.04 to service assistants and instructors, $1.68 to experienced telephone operators, and $1.34 to operator trainees. By region, average hourly earnings of experienced telephone operators ranged from $1.41 to $1.80.

Earnings of telephone operators increase considerably as the employee gains experience and skill. For example, under the 1958 wage schedule in one of the higher pay scale cities, telephone operators start out at a basic weekly rate of $55.00 and receive periodic increases to a maximum of $72.50 after a period of at least 6 years. Service assistants receive $9.50 a week above the operator schedule rates. Evening and night differentials are paid to operators whose tours of duty end after 7:30 p.m. They range from 40 to 80 cents extra pay for each evening worked. Operators who work on all-night tours of duty receive an extra $1.20 for each night worked. Telephone operators are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 702.)

The rooms where the telephone operators work are generally well lighted and well ventilated. Adjustable seats are provided for the operators. However, workrooms are rather confining and the headsets may become uncomfortable, especially in the summer in buildings without air conditioning. Most companies provide pleasant, attractive lounges for operators to relax in during rest periods. Many of the larger central offices also have cafeterias where inexpensive hot foods and drinks are served throughout the day.

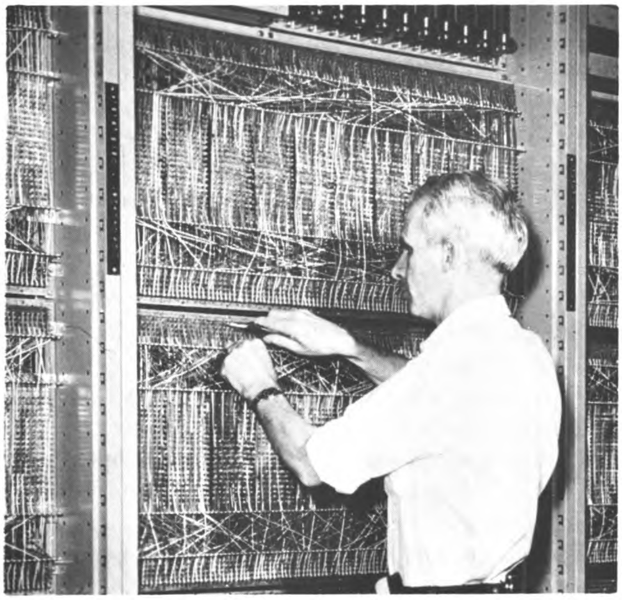
Since the telephone industry gives continuous service at all hours every day in the year, many operators work night and evening hours, Sundays, and holidays. The basic workweek is 40 hours. However, many operators work split shifts in order to handle the peak calling loads in late morning and early evening hours. For example, an operator may have a tour of duty from 8 a.m. to noon and from 4 p.m. to 8 p.m. Because seniority usually determines the selection of tours, new workers are most likely to be assigned to split shifts. Telephone operators are also subject to emergency callouts although this happens very rarely.

Central Office Equipment Installers

(D.O.T. 5–53.010)

Nature of Work

Most of today's central office switching and dialing equipment is so large and complex that it cannot be moved into a telephone exchange in complete units. It must be manufactured and installed section by section. Central office equipment installers make these installations on the premises of the local telephone companies. They assemble, wire, and test the complex array of equipment in locations designated in floor plans, making sure that the central office equipment, which is the heart of the telephone system, conforms to the manufacturer's standards to provide efficient and dependable service. Installation jobs may involve equipping a new central office, in-



Central office equipment installer making a final check of dial switching equipment in a central office.

stalling additional units in an expanding local office, or replacing outmoded equipment with new types of equipment.

Central office equipment installers are not employed by telephone companies but by manufacturers of telephone equipment. Most installers work for one large manufacturing company which provides and installs central office and private branch equipment for its associated companies. A few smaller firms manufacture and install equipment for many of the independent companies.

Central office equipment installers are required to travel to various telephone offices within their assigned areas. Although these areas may cover several States, their work is usually located in or near the larger cities in which they reside. On small jobs, such as installing a switchboard in a small community, an installer may be teamed with only one or two other installers. However, when a long-distance toll center is to be installed in a big city, he may work with hundreds of other installers.

Training, Other Qualifications, and Advancement

Employees usually require applicants for jobs as installers to have a high school education or its equivalent. Men with some college education are often hired for jobs as installers. They have some advantage in competing for advancement within the company, especially if they have engineering training. It is absolutely necessary that the applicant be willing to travel. Preemployment tests are generally given to determine the applicant's mechanical aptitudes.

The new employee receives on-the-job training supplemented by classroom instruction. He usually attends classes for the first few weeks to learn the basic operations of installation. After this short period, the trainee is assigned to a supervisor and starts his on-the-job training working with experienced installers. After several years of experience, he can qualify as a skilled installer. Training on the job, however, continues even after he has become a skilled worker. Technical courses are given from time to time to improve the skill of the experienced installer and to train him on new equipment and techniques.

Employment Outlook

The development and installation of new types of telephone equipment and the general expansion of telephone service are expected to result in a moderate increase in employment of installers during the 1960's. Openings will also arise from retirements, deaths, promotions, and transfers out of the occupation.

A tremendous postwar expansion in central office facilities of telephone systems all over the country resulted in a rapid rise in the employment of installers. The employment of installers by the chief manufacturer of telephone equipment illustrates the growth in this occupation. By 1947, the number of installers employed by this company had grown to more than 25,000 compared with a prewar peak of 11,500 in 1941. As the backlog of requirements for the installation of new or additional central office equipment was reduced, there was a gradual decrease in the number of central office installers so that by the end of 1950, the company employed 10,000 of these workers. By mid-1958, there were approximately 15,000 installers employed. Unlike many other occupations in the telephone industry, the employment of installers is more directly affected by general economic conditions which influence plans for expansion or modernization. The development and increased use of new types of telephone equipment, such as long-distance dialing facilities and microwave stations, as well as the need to modernize existing central office equipment are expected to result in a moderate increase in the employment of installers in the 1960's.

Earnings and Working Conditions

Trainee installers earn $1.50 to $1.57 an hour, depending on locality, according to the major union contract in effect in October 1958. The contract provides for periodic increases until the employee reaches a rate of $2.44 to $2.56 an hour after 6½ years of experience. Employees may also receive annual merit increases above these maximum rates up to $2.81 to $3 an hour. Time and a half is paid for work in excess of 8 hours a day or 40 hours a week, and double time is paid for work on Sundays or holidays. A majority of the installers are granted 9 or 10 holidays a year. Vacations are granted according to length of service. A worker with 1 year of service receives 1 week's vacation; 2 to 15 years of service, 2 weeks; and over 15 years of service, 3 weeks. Most central office equipment installers are represented by the Communication Workers of America.

Agricultural Occupations*

Around 100 years ago, Abraham Lincoln said, "No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought as agriculture." In its general aspects, this statement is as true today as it was 100 years ago.

Despite all the specialization and mechanization—and there has been much of both in every human endeavor—the farmer still functions in many capacities and makes many independent decisions. The typical farmer is a manager, a supervisor, and a laborer. He has to know about insects, bacteria, fungi, and viruses, as well as a wide variety of crops and animals. He buys a host of different items from various types of dealers and sells his products in many kinds of markets. In some respects, he acts as a lawyer, a bookkeeper, and a financier. He is a consumer and a producer who has many and varied competitors.

As a way of life, farming offers advantages that are attractive to many families. Some people like the greater independence and freedom associated with various phases of farmwork and the variety of jobs associated with farming. They like living on a farm or in a small community and are willing to accept lower incomes than they could consider satisfactory in an urban environment. With modern means of transportation and communication, many of the former differences between rural and urban living are vanishing. Many people try to combine the best of both worlds by living in the country and working in town. Many consider the country a better place in which to raise children. But a larger number remain on farms because they have no better alternative; they are either too old for, or otherwise unsuited to, other kinds of work.

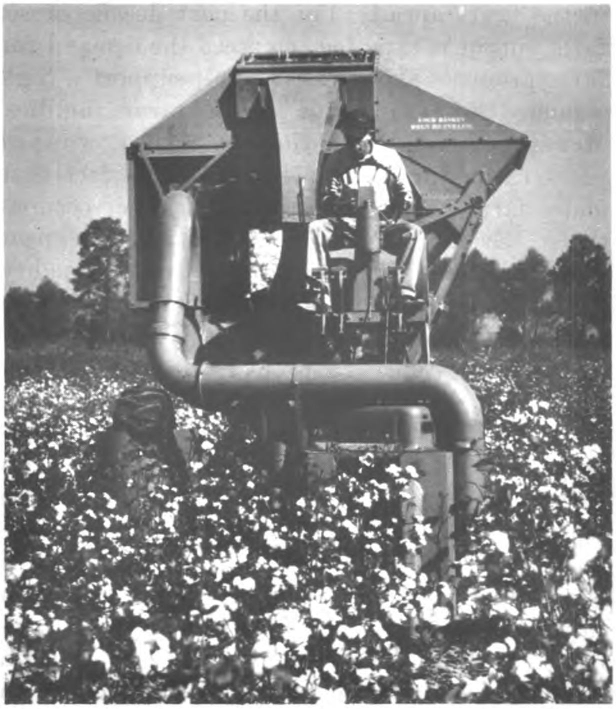
Significance of Agriculture in the Economy

Our agricultural economy, our methods of farming and the resources required to finance a farm business have changed greatly in the last century. Our national economy is no longer predominately agricultural. Today, about 9 percent of our total civilian labor force is in agriculture. Less than 12 percent of our total population live on farms now compared with 65 percent in 1860. One farm worker can now produce food and fiber for himself and 23 other people, compared with only 4 others in 1860. The typical farm has increased in size and is mechanized to a greater extent than ever before. This means that a great deal more capital is required now to own and operate a farm. Just 20 years ago a typical hog-beef fattening farm in the Corn Belt averaged about 180 acres in size and represented a capital investment of about $20,000. On January 1, 1959, the typical farm averaged nearly 210 acres, and the total investment was about $65,200. On January 1, 1959, the capital investment in machinery and equipment averaged about $7,200 per farm, compared with less than $1,800 a generation ago.

The standard of living today on our farms is the highest in history. Farm assets are at an all-time high—nearly four times as high as in 1940. Two in three farms are completely free of mortgage debt. As a group, farmers have only $11 in debts for each $100 of assets, compared with $19 in debts for each $100 of assets in 1940. The improved financial position of farmers, however, is due partly to the recent upward trend in farm real estate values. Since 1940, the average per acre value of farm real estate has increased from $32 to more than $100. Farmers who owned land during this period were able to take advantage of the rise in land values as well as the high level of farm incomes associated with World War II and the Korean conflict. But during the period 1920–39, both land values and farm incomes tended to decline. As a result, persons who had borrowed money with which to buy farms around 1920 were hard pressed to make ends meet.

Whether the next 20 years will be like the 1940–59 period rather than the 1920–39 period is difficult to foresee. Much depends upon the future trend of the general price level and whether

* Prepared by the U.S. Department of Agriculture.



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A mechanical cotton picker can gather as much cotton as 20 men can pick by hand.

we shall be able to avoid another war. Historically, when the country has been at peace, farm incomes have tended to be lower in relation to those of industrial workers than in wartime.

Investment per Worker in Agriculture and Rate of Return

Since before World War II, American agriculture has experienced a spectacular rise in the value of productive assets relative to the number of workers. Higher land and equipment prices and the substitution of machinery for labor have been chiefly responsible for this increase. The investment per worker in land, farm buildings, livestock, machinery, equipment, and other capital items amounted to more than $18,000 in 1958, compared with less than $4,000 in 1940. In physical terms (value at 1947–49 prices), the quantity of all productive assets per farm worker has nearly doubled since 1940, whereas the quantity of farm machinery and equipment alone has nearly quadrupled. The march of technology has brought to the farmer many new kinds of labor-saving and production-expanding aids. This technological progress has increased the skills required for many farm jobs and has raised the amount of capital a man must have to become a farm operator.

The rate of return on farm capital (current value of farm real estate and other physical assets) in the United States over and above all other production costs except interest has fluctuated widely through the years, ranging from small losses in 1930–32 to record high returns of 10 to 12 percent in 1942–43 and again in 1948. (Production costs include a charge for the farm operator and family labor at going wage rates.) The exceptionally high rate of return in 1942–48 resulted from the fact that market values of farm real estate, and other assets increased at a slower rate than net farm income. The decline in the rate of return has been particularly sharp since 1951 as market values of real estate have continued to advance without corresponding increases in net returns. The rate of return on all farm capital in 1958 (3.7 percent) was only slightly above the 1957 rate, which was the lowest since 1934.

Size of Farm Operations

Farms in the United States have been classified by the Census according to the value of their annual sales. The data show that the business firms in agriculture—the farms—vary widely so far as size of operation is concerned. In 1954, about 7 in 10 farms were classified as commercial (those providing the farmer with his major source of income) but less than 3 in 10 reported sales of $5,000 or more. From these data, it is clear that most farms are too small to provide more than part of the income needed to support a satisfactory standard of living. However, the trend is toward fewer and larger farms. For farm operators, the consolidation of farms into larger units means that more managerial skills, more capital, and more mechanical equipment are needed.

Employment Outlook

The farm employment situation is unfavorable basically because too many people are employed in agriculture. Although the trend in the number of farm workers has been downward, the shift to other occupations has not yet proceeded far enough in the country as a whole to bring human resources into balance with job opportunities in farming.

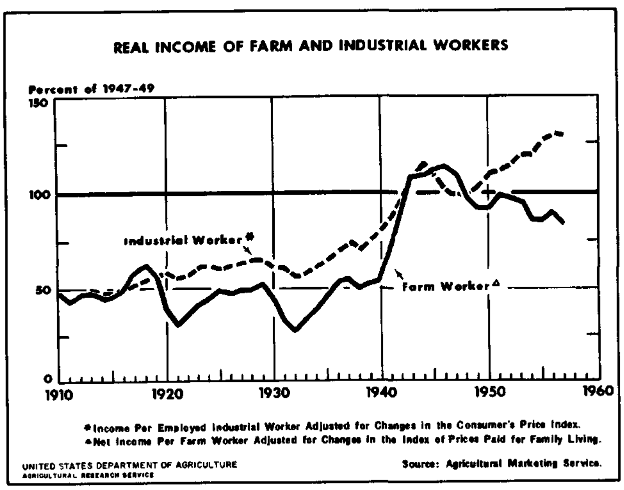
For some years to come, the number of desirable openings in agriculture for new workers will be less each year than the number of workers who retire, die, or leave for other reasons. Probably the numbers of both farm operators and other farm workers will continue to decline. By 1975, the number of persons employed in agriculture may be a fourth less than the number employed in 1957.

During the 1955–64 period, an estimated 227,000 farm operators (those selling as much as $5,000 worth of farm products annually) are expected to leave the occupation because of retirement or death. Since there were 2,200,000 farm boys 10 to 19 years old in 1954, obviously only a small proportion of these boys will have the opportunity to become operators of medium-size to large farms. Those who did not grow up on farms will have even less chance of becoming farm operators.

Unlike many other segments of the economy, agriculture cannot anticipate any general increase in per capita consumption of its products. Expansion of domestic markets will, therefore, depend mainly on growth of the population.

Because of the rapid advances in technology, farming probably will become more competitive

CHART 50



in the years ahead. For the next decade or so, farm output is expected to exceed the demand for farm products at prices that will support a high standard of living for many farm families. Mounting surpluses continue to exert downward pressure on farm incomes despite the fact that many farm people have turned to other occupations. Even though the Government has spent billions of dollars to support farm commodity prices in recent years, real incomes of farm workers have tended to decline while those of industrial workers have tended to rise (chart 50).

Despite the less than rosy outlook for job opportunities in farming, agriculture will remain one of the largest areas of employment in the economy. Moreover, an expanding list of openings in fields closely related to agriculture will be available. In 1957, an average of 6.2 million employed persons (farm operators, unpaid family workers, and hired farm workers) worked on farms, but about as many more were engaged in closely related activities. Some of them were producing such farm supplies as fertilizer, processed feed, and machinery. Others were engaged in transporting, storing, processing, packaging, or otherwise fabricating or handling farm products along the route from the farmer to the final consumer. Increased employment in these areas of work will tend to compensate for declines in employment on farms.

Opportunities for Hired Workers on Farms

Most of the workers on farms are either self-employed farm operators or members of farm families. The number of hired workers on farms (including members of farm families who are paid wages) fluctuates seasonally from about 1 million in January to nearly 3 million at the peak of the harvest in September. Roughly three-quarters of a million hired workers are employed on farms for at least 150 working days during the year. The rest, including many students and housewives, work chiefly during the harvest season. Also included in this group are nearly a half million hired farm workers who follow the crops each year. Most of these migratory workers travel northward as the season progresses and return to the South after the last harvest.

Although farm wage rates are more than four times as high as they were in 1940, they are still low in relation to earnings of factory workers. Ordinary farm work is excluded from the coverage of the minimum wage law. Average farm wage rates in the United States as of October 1, 1958, were as follows:

Per month with house	$176.00
Per month with board and room	138.00
Per week with board and room	34.25
Per week without board or room	42.25

Employment opportunities for hired farm workers vary from season to season and also among geographic areas. Specific information concerning the kinds of jobs available and current wage rates may be obtained from the local offices of the State employment services.

Training Opportunities Available for Farming

The best initial training for farming is to grow up in a farm family. However, if one does not have an early farm background, the necessary experience can be gained as a hired worker on a successful farm.

Several types of vocational training are available under the Smith-Hughes Act, which, among other things, provides for the teaching of agriculture in the high schools. The training includes:

1. All-day programs supervised by teachers who are agricultural college graduates;
2. Young farmer programs consisting of short courses carried on during the day, with intensive training in some aspects of farming, such as growing broilers or breeding cattle; and
3. Adult farmer programs in evening classes (or day classes in offseasons) giving intensive training in special problems, such as control of pests, planning adjustments in land use and treatment, and so on.

The most significant general sources of information and guidance available to farmers are represented by the network of services provided by the land-grant colleges and universities and the U.S. Department of Agriculture. These services include the facilities of the various State and Federal experiment stations, the Extension Services, and resident teaching. The local county agricultural agent is frequently the best point of contact for the young person who is seeking advice and assistance in farming. The Farmers Home Administration's system of supervised credit represents one example of credit facilities combined with a form of extension teaching. Organized groups such as the Future Farmers of America and the 4–H Clubs also furnish valuable training to young farm people.

OPPORTUNITIES ON SPECIFIC TYPES OF FARMS

In the preceding section, it was pointed out that the number of desirable openings in farming are limited. Nevertheless, in a field as large as this, a considerable number of openings will occur each year.

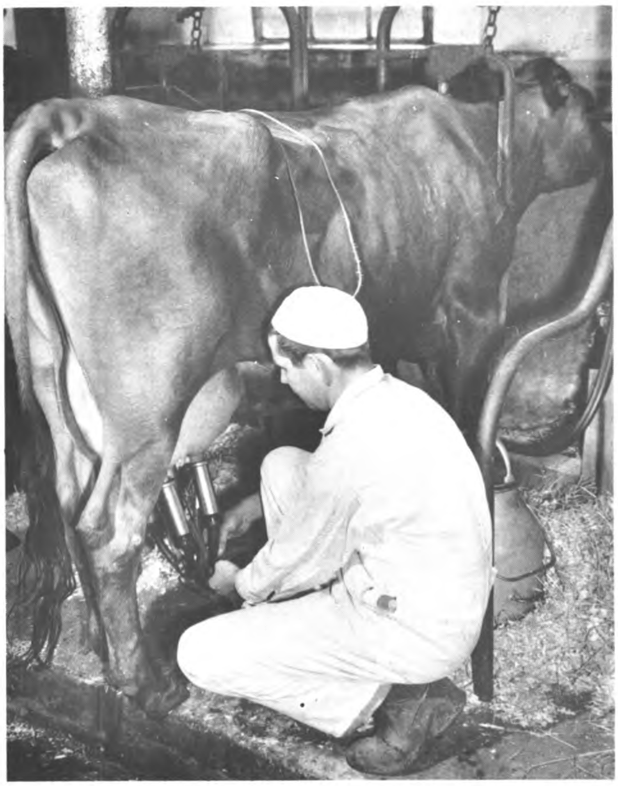
Each year also, many young people must decide whether to go into farming or some other line of work. For some people, this decision may be influenced by the fact that there may be an opening on the home farm or on one nearby. Others may decide to go into farming and then look around to see what opportunities are available. But if their choice is to be a sound one, it will need to be made between *specific types of farming* and specific lines of nonfarm work.

Whether or not a specific farm situation is involved, the particular requirements of each type of farming under consideration and the prospects for success in it should be appraised carefully. Each person must make this appraisal in the light of his aptitudes, his interests and preferences, his experience and knowledge, and his skills in directing labor and handling livestock or machinery. His choice must take into account also his family labor supply and his financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

As a realistic decision to go into farming or stay out of it can be made only in terms of a particular type (or types) of farming, this section evaluates some of our more common types from an occupational standpoint. Illustrative data on land, labor and capital requirements, and net farm incomes received by operators of farms common in various parts of the country are shown in table 1. On most of the farms, the major part of the work is done largely by the farm operator with some help from his family. The smaller farms may hire some help during peak labor seasons, whereas some of the larger ones often use hired labor the year around.

The figures on capital invested should not be interpreted to mean that the operator must have that much money saved up in order to get started. They indicate only that on these farms, operators *control* or use resources of this value or amount. Many farmers supplement their own capital with borrowed funds; others rent part or all of the land they use, thus allowing more of their own funds for the purchase of livestock and machinery. Still others have partners who provide most of the working capital. For example, many farmers raise broilers in partnership with a feed dealer.

Before discussing in greater detail the various types of farming, it may be well to mention the question of specialization versus diversification. No brief general statement can be made that would apply in all parts of the country, but the general trend is in the direction of more specialized farming. Farms that produced a number of different products a generation ago may now produce only two or three. One of the main



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Most of the milking on commercial dairy farms is done by machine.

TABLE 1. *Land in farm, labor used, capital invested, and net farm income, commercial farms by type, size, and location, 1953–57 average*

Item	Total land in farm (acres)	Total labor used (hours)	Capital invested in—				Total farm capital	Net farm income
			Land and buildings	Machinery and equipment	Livestock	Crops for sale, feed, and seed		
Poultry farms, New Jersey (egg producing)	10	6,020	$35,140	$1,640	$7,190	0	$43,970	$2,715
Dairy farms:								
Central Northeast	204	4,420	15,240	5,060	5,980	$2,640	28,920	4,150
Eastern Wisconsin	128	4,450	20,270	6,710	4,920	2,290	34,190	3,410
Western Wisconsin	146	4,030	11,580	5,140	4,450	1,730	22,900	2,865
Dairy-hog farms, southeastern Minnesota	153	3,850	21,710	6,140	4,940	2,810	35,600	3,760
Corn Belt farms:								
Hog-dairy	163	4,430	27,100	5,710	5,570	5,200	43,580	5,640
Hog-beef raising	223	3,520	23,290	4,120	5,520	3,210	36,140	3,315
Hog-beef fattening	201	4,110	37,820	7,040	9,550	6,030	60,440	7,065
Cash grain	230	3,330	73,430	6,810	2,430	8,040	90,710	7,855
Tobacco farms:								
Tobacco-livestock (Kentucky)	115	3,920	19,420	2,060	1,810	860	24,150	3,165
Tobacco-cotton (North Carolina)	100	6,610	17,520	2,640	610	620	21,390	3,135
Small tobacco	50	3,590	8,980	1,160	420	370	10,930	2,575
Large tobacco-cotton	170	9,840	31,420	5,080	1,150	1,090	38,740	3,910
Cotton farms:								
Southern Piedmont	177	4,300	13,210	1,650	720	480	16,060	1,790
Black Prairie, Texas	177	3,870	22,250	3,030	1,110	580	26,970	2,140
High Plains, Texas (nonirrigated)	370	3,100	32,460	6,810	540	390	40,200	1,605
High Plains, Texas (irrigated)	324	7,580	71,940	12,930	700	690	86,260	10,600
Delta:								
Small	57	3,070	7,630	2,450	400	230	10,710	1,720
Large-scale	1,000	36,370	129,540	27,120	7,320	3,130	167,110	19,915
Peanut-cotton farms, Southern Coastal Plains	136	4,090	6,700	1,660	830	430	9,620	2,710
Spring wheat farms (Northern Plains):								
Wheat-small grain-livestock	690	3,140	25,920	9,330	2,730	5,970	43,950	4,600
Wheat-corn-livestock	484	3,900	24,580	8,620	5,090	4,450	42,740	3,700
Wheat-roughage-livestock	773	3,490	22,900	7,940	4,450	5,010	40,300	3,775
Winter wheat farms:								
Wheat, Southern Plains	707	2,470	59,830	8,620	3,590	3,610	75,650	5,295
Wheat-grain sorghum, Southern Plains	720	2,920	63,500	7,770	2,860	2,610	76,740	2,780
Wheat-pea (Washington and Idaho)	534	3,310	124,130	14,430	1,760	8,470	148,790	13,895
Northern Plains ranches:								
Sheep	6,217	8,050	54,560	6,870	19,910	3,160	84,500	6,305
Cattle	4,146	4,270	42,920	7,560	15,630	4,870	70,980	3,445
Cattle ranches, Intermountain region	1,700	4,890	28,980	4,240	28,320	4,260	65,800	5,735
Southwest ranches:								
Sheep	12,882	5,160	156,560	4,640	18,210	2,820	182,230	2,360
Cattle	10,688	3,610	107,960	3,710	20,550	2,580	134,800	1,295

reasons for this is that efficient production of most farm products requires substantial investments in specialized equipment. In order to reap the full benefit from these investments, the overhead cost of this equipment must be spread over many units of product. Two other factors are the greater emphasis in farm product markets on quality, and the increased knowledge and skill required for effective production of each farm product.

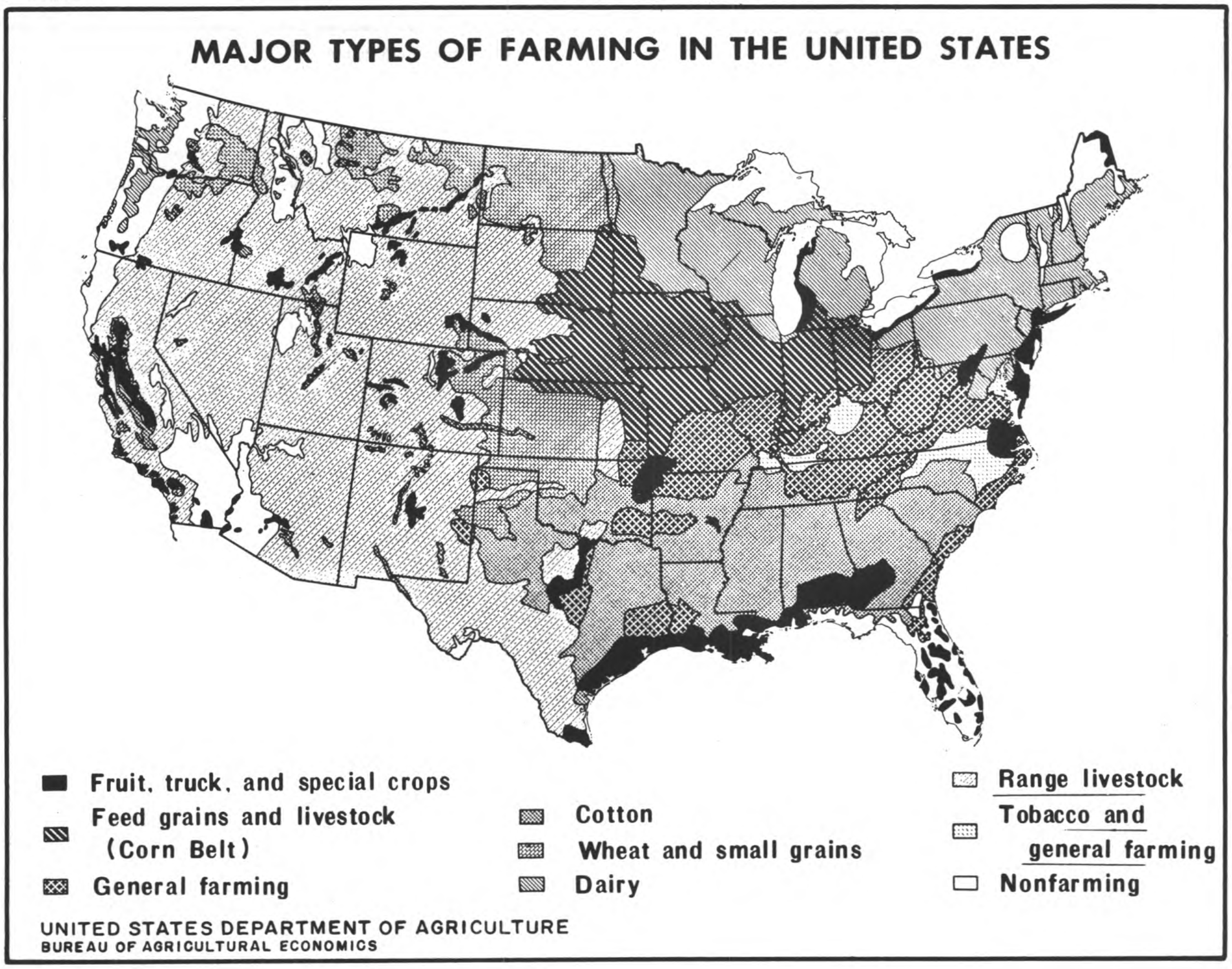
Relatively few farmers, however, find it to their advantage to produce only one product. Chief among the reasons for this are the spreading of price and production risks, and the more effective use of labor, particularly family labor, and other resources that might be virtually wasted in a one-product system of farming.

Dairy Farms

Dairy farms are found in most parts of the country. Despite our modern methods of processing and transporting milk, dairy production is still concentrated near the large population centers. A large part of the total national production of dairy products is concentrated in the Northeastern States and the Great Lakes States (chart 51). Although crop work causes peak labor loads, especially at harvesttime, there is plenty to do throughout the year on dairy farms. This has its advantages from the standpoint of effective use of labor, as a regular force can be kept fully occupied most of the time.

Most people, however, do not like to be "tied down" 7 days a week. But for the man who

CHART 51



likes livestock and enjoys working with them, this is not too hard to take.

Dairying is also a good choice for the man who likes to work with mechanical equipment. As dairy farmers usually produce most of their feed requirements, there is enough variety in the work to keep it from becoming too tiresome.

The financial problem of the dairyman is somewhat simplified by the fact that his income is distributed throughout the year. Moreover, the prices he receives for his product and his income are usually less subject to the marked year-to-year fluctuations experienced by operators of some other farms. Table 1 shows the average net farm income in the 1953–57 period on dairy farms in the central Northeast and the Midwest.

Dairy farmers in the more concentrated milksheds of the Northeast, such as the dairy farms in the central Northeast shown in table 1 and chart 51, frequently milk larger herds, buy a larger proportion of their feed requirements, and are more likely to buy rather than raise their herd replacements than are farmers in other areas. Perhaps the most highly specialized producing area is the "dry lot" dairy area near Los Angeles. In this area, dairy farms are quite small in terms of acreage, but large in number of cows milked. No crops are produced. Instead, these dairy operators buy their entire feed requirements, which are shipped in from outside the area. Most of the cows are bought at freshening time and are replaced when their lactation period is completed. These highly specialized operations are virtual "milk factories."

Net farm income represents the return to the farm operator for his own and his family's labor, and for the capital invested in the farm business. For simplicity and for comparison, it is assumed that the farmer owns all of his land and is free from debt. In the case of the farmer who rents part or all of his farm, not all of net farm income is available for family living. Part of it must be used to pay the rent. Likewise, part of this net farm income must be used to meet interest and principal payments by the farmer who is in debt.

For example, lenders usually consider a 2 to 1 ratio of assets to liabilities a safe one, which means that for the eastern Wisconsin dairy farm shown in table 1, with land and buildings worth a little more than $20,000, they would consider a $10,000 mortgage a reasonable one. If this were set up on a monthly level-payment (Standard) plan at 5-percent interest, the monthly payments ($65.42) would total about $785 per year; that is, the farmer who is meeting such a repayment schedule has $785 less available for family living than one who is free from debt. Although this qualification is made here in connection with the income data for dairy farms, it should be borne in mind that it applies equally well to the income figures shown for other types of farms.

Livestock Farms and Ranches

On general livestock farms, such as the hog-beef raising and the hog-beef fattening farms of the Corn Belt (table 1 and chart 51), there is considerably less daily "chore work" to be done than on dairy farms. Many farmers would consider this to be a big advantage. Although this means that livestock producers often do not work as long hours as dairymen, it means also that they may not make as effective use of the regular labor force during slack seasons. This is not too serious when a substantial part of the labor force is made up of youngsters of school age, as the busiest times on the farm come mainly when the children are out of school.

As with dairy farms, general livestock farms are good choices for farmers whose interests and skills lie in the direction of livestock, mechanical equipment, and crop production.

The livestock farmer's income is not as well distributed throughout the year as that of the dairymen, nor is it likely to be as uniform from year to year. To some extent, this complicates his financial management problem and increases the risk of the operation, as compared with that of the dairyman. Moreover, on farms of rather limited acreages, which are often found in the Eastern States, the level of income with general livestock is usually lower than is the case with a dairy herd on a similar acreage.

Most hog producers have their own breeding stock and raise the pigs they fatten for market. With cattle and sheep, however, the situation differs. Most of the cattle and sheep finally marketed by the livestock farmer are produced originally by someone else—usually the livestock rancher of the West. Five typical situations of this type are shown in table 1 and chart 51—Northern Plains sheep and cattle ranches, Intermountain cattle ranches, and sheep and cattle ranches in the Southwest. In these areas of low rainfall, the main source of feed is range grass. Several acres may be required to support one animal. Except where irrigation water is available, few feed crops are harvested. Some of these ranchers, particularly those in the Intermountain region and Northern Plains, own only a relatively small part of the land they operate. The bulk of it is public land on which they buy the rights to graze their livestock. Large acreages are required to provide enough pasture for their stock, so the ranchers spend much of their time in the saddle, truck, or jeep, managing their herds.

COURTESY OF U.S. DEPARTMENT OF AGRICULTURE

Rounding up cattle in the fall requires considerable know-how of both rider and horse.

Poultry Farms

Most farmers in the United States keep some poultry, but in the 1954 census, less than 5 percent of them were classified as poultry farmers. Many poultry farmers concentrate on production of eggs. Most of the larger and more specialized of these farms are found in the Northeastern States and in California. Other poultry farmers produce broilers. There are a number of highly concentrated centers of broiler production east of the Mississippi River and a couple on the West Coast. There are also specialized turkey producers, and even a concentration of specialized producers of ducks in Suffolk County, Long Island, N.Y.

Although poultrymen sometimes produce some crops, the crops are usually sold and special poultry feeds and laying mash are purchased. Most specialized poultry producers, particularly broiler operators and operators of large laying flocks buy all their feed. The typical commercial poultryman in New Jersey, for example, produces eggs entirely with purchased feed. The typical broiler producer on the Delmarva (Delaware, Maryland, Virginia) peninsula and in northern Georgia grows broilers only. The work requires some specialized skill in handling birds, but little skill is required of anyone except the operator. Not much is demanded in the way of physical strength as the tasks involved are not arduous. Therefore, poultry farms can make good use of available family help.

COURTESY OF U.S. DEPARTMENT OF AGRICULTURE

Poultryman dumping feed into hopper of his automatic feeder.

Investment requirements and average net farm income for the 1953–57 period for representative egg producers in New Jersey are shown in table 1. These averages do not reveal the sharp ups and downs in income that these producers experience from year to year. Because these egg producers have a high proportion of cash costs and a rather thin margin of profit, relatively small changes in feed and egg prices can produce sizable fluctuations in income.

The incomes of most broiler growers, on the other hand, are somewhat steadier. Perhaps the main reason for this is the high proportion of broiler growers who produce "under contract." Contract production is much more widespread in broiler production than in nearly any other major agricultural product. Under these arrangements, the financing agency—usually a feed dealer—furnishes the feed, chicks, and technical supervision. The feed dealer furnishes virtually everything except the direct production labor and the buildings and equipment. The grower gets a stipulated amount per bird marketed, and often a bonus for superior efficiency in converting feed into broilers.

Many turkey producers operate under similar contracts, but the practice is not nearly so universal as in broiler production.

Corn and Wheat Farms

For the man who doesn't care much for livestock or poultry, but enjoys working with crops and farm machinery, cash grain or corn or wheat farming has much to offer. Many farmers would rather not be tied down all year round; they do not mind working long hours during the busy seasons if they can operate with mechanical equipment and can take things easy when the rush times are over. They choose to operate a crop rather than a livestock farm.

COURTESY OF U.S. DEPARTMENT OF AGRICULTURE

Mechanical equipment greatly reduces the time needed to produce a crop of corn.

The investment required and the recent income experience on some representative cash grain farms are shown in table 1. Farms of this type include cash grain farms in the Corn Belt, spring wheat farms in the Northern Plains, winter wheat farms in the Southern Plains, and wheat-pea farms in Washington and Idaho. Although some of these farmers, and particularly those in the Northern Plains, usually raise some beef cattle for sale as feeders and keep a few milk cows, livestock production is usually of secondary importance. In many instances, it is absent entirely.

One of the main risks faced by the commercial wheat grower is the uncertainty of weather. At present, we have a large surplus of wheat. Although there is also some price risk, wheat prices have been stabilized to some extent by the Federal Government's price-support program.

Cotton, Tobacco, and Peanut Farms

In terms of numbers of farmers, production of cotton, tobacco, and peanuts makes up a substantial part of the agriculture in the Southeastern and South Central States. Farms on which these products are grown vary from very small operating units to comparatively large ones. Competition among these growers has been noticeable, and many have been forced to diversify and enlarge. Both of these adjustments require expenditure of capital. Industrial expansion in the South, and competition from growers in the irrigated cotton areas of the West and Southwest have forced many cotton farmers in the Southeast out of the cotton business. Some of these operators have quit farming, and some have diversified their operations. Cotton, tobacco, and peanut allotments are rigid and competition will continue.

Crop Specialty Farms

Many farmers throughout the country have special resources and advantages chiefly because of location. These operators may specialize in production of a single crop, such as grapes, oranges, potatoes, sugarcane or melons, or a combination of related crops.

Operators of these types of enterprises usually employ considerable labor and require relatively expensive specialized equipment. They also need specific skills, many of which can be obtained only through experience. None of these operations should be undertaken unless the person has

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Small plastic siphons are often used to assure an even flow of water from distribution ditch to individual rows.

had considerable experience and has developed some of these special skills and techniques. An alert individual with reasonable aptitude can usually obtain these skills by working as a laborer for a good operator for a few years or by operating as a tenant for a landlord who is able to give direction and assistance.

Annual returns from these specialty farms usually vary greatly from year to year. Ordinarily, production is subject to considerable variation because of the vagaries of nature and the variation in prices during the marketing season. In general, operators here are well rewarded for their ability to market. They must keep abreast of production and marketing conditions.

Other Specialties

Other highly specialized operations, which include fur farms, apiaries, hop, cranberry production, and the like are very sensitive to price and market conditions. Special skills and equipment are required and risks are high. But even with the high risk, from the standpoint of capital invested and income, the venture is often rewarding to individuals who have the ability and the resources to undertake it. If he is to succeed, the operator of such a farm must be enterprising and alert, must keep abreast of production and markets, and must have the ambition and desire to accomplish his objective.

SPECIALIZED AGRICULTURAL OCCUPATIONS

As agriculture becomes more technical and commercial, the number of people directly engaged in farming decreases but the number who engage in services related to agriculture multiplies rapidly. Power machinery, for example, saves many man-hours of labor on the farm but calls for a staff of workers to design, produce, and distribute the machines used by the farmers.

A large number of the vocations that are growing up around agriculture are of a professional or technical nature and call for college training or its equivalent.

Other vocations are in the nature of special services to farmers which can sometimes be learned through on-the-job training. For many of these positions, a farm background is not essential, although it may be helpful. The American Association of Land-Grant Colleges and State Universities reported in 1958 that 15,000 college graduates could have been employed in agriculture and related fields but that the land-grant colleges graduated only 8,500. The number of openings in the various fields were reported as follows:

Agricultural research	1, 000
Agricultural industry	3, 000
Agricultural business	3, 000
Agricultural education	3, 000
Agricultural communications	500
Agricultural conservation	1, 000
Agricultural services	1, 500
Farming and ranching	2, 000

Agricultural Extension Service Workers

(D.O.T. 0–12.20)

Nature of Work

Cooperative Extension Service workers are joint employees of their State land-grant college and the U.S. Department of Agriculture who engage in educational work in agriculture and home economics. Because their work is primarily educational, extension workers must be proficient in both subject matter and teaching methods.

County agricultural agents are concerned primarily with increasing the efficiency of agricultural production and marketing, including the development of new market outlets. County *home demonstration agents* work closely with women in such fields as home management and nutrition.

Agricultural extension workers try to help people analyze and solve their problems. In doing this, extension workers help local people apply the results of research and practical experience to their problems. Much of this educational work is with individuals and groups through meetings, tours, and demonstrations. Individual assistance is given to farmers and homemakers on problems that cannot be solved satisfactorily by group methods. Both the county agent and the home agent, along with the 4–H Club agent in counties that have one, work with rural youth in organized groups on projects related to agriculture,

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Extension entomologist showing farmer how army-worms have stripped the leaves from his wheat.

homemaking, and community improvement. Extension workers rely heavily on the use of mass communications media, such as newspapers, radio, and television.

The work of the county extension staff is backed by State extension specialists in such subject matter fields as agronomy, livestock, marketing, agricultural economics, home economics, horticulture, and entomology. These specialists keep abreast of the latest research findings in their particular field and work with agents in applying them to local needs and problems.

Where Employed

Extension agents are located in nearly every agricultural county in the United States. In counties with a large number of farmers who produce a variety of crops, there may be as many as 10 or more agents on the county staff. In these counties, the agents usually specialize in particular fields, such as dairying, poultry production, crop production, or livestock.

Training and Other Qualifications

The first qualification for a county agent is a bachelor's degree in agriculture or home economics. In most States, the Extension Service maintains an in-service training program to keep its agents informed of the newest findings in agricultural research, of new programs and policies that affect agriculture, and new teaching techniques. To be successful, extension workers must like to work with people.

In most instances, specialists on the State staff are expected to have the master's degree and a special training in their particular lines of work.

Employment Outlook

The Cooperative Extension Service has experienced a constant growth, and the demand for new extension workers continues. There are approximately 15,000 extension service workers in the United States. As agricultural technology becomes more complicated, there is an increasing demand by farmers for trained personnel to assist them in applying this technology. Moreover, as farm people become more aware of the need for organized activity, they make additional requests for increases in Extension Service personnel. Rural nonfarm families, including suburban residents, are also demanding more and more educational assistance from extension workers, and are extending the work of the Extension Service to new segments of our population.

Counterparts of the Agricultural Extension Service are being established in many countries of the world and Extension Service personnel are often recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension agents vary from State to State and county to county. In October 1958, the average annual starting salary of assistant agricultural agents was about $4,400, and of home agents approximately $4,100; starting salaries for assistant agricultural agents ranged from $4,000 to $5,400.

The successful assistant agent ordinarily is promoted rapidly. Promotion may occur in the county where employed as an assistant agent or through being shifted to a more responsible job in another county in the State. Salaries for agricultural agents range from $7,500 to $11,500, with top salaries averaging around $8,500 a year. Salaries of experienced home agents range from $5,500 to $9,700 annually, the top salaries averaging $6,500.

Hours of work are long and very irregular. Many evenings are devoted to meetings with farmers and other groups. The work is of a highly responsible nature and agents must maintain good working relationships with both farmers and other segments of the community.

Where To Go for More Information

For additional information get in touch with County Extension Offices, State Directors of Extension located at each State College of Agriculture, or the Federal Extension Service, U.S. Department of Agriculture, Washington 25, D.C.

(See also statement on home economists. Refer to index for page number.)

Vocational Agriculture Teachers

(D.O.T. 0–31.01)

Nature of Work

Vocational education in agriculture is a nationwide, federally aided program of systematic instruction in agriculture and farm mechanics of less than college grade, conducted in public schools or classes for those persons over 14 years of age "who have entered upon or who are preparing to enter upon the work of the farm or the farm home." The program operates under a plan of cooperation between State Boards for Vocational Education and the Office of Education, U.S. Department of Health, Education, and Welfare.

For high school students, the teacher conducts classes in agriculture with subject matter selected to fit the needs of persons enrolled and of the particular community. Each student is required to conduct a farming program, either at home or on facilities provided by the school, with year-round supervision by the teacher. Students generally start with small farming programs but are encouraged to expand their enterprises as rapidly as they can so that by the time they have completed high school, they will have built up an investment in farming large enough to permit them to farm on a full-time basis or to enter upon a sound partnership agreement with parents.

Along with class instruction and supervision of farming programs, teachers of vocational agriculture give instruction in farm mechanics in school farm shops. Students learn the operation and maintenance of farm machinery, utilization of electrical equipment, and construction of such equipment as farm water systems, feeders, brooders, fences, and small buildings.

The teacher of vocational agriculture also serves as adviser to the local chapter of Future Farmers of America, an organization that engages in a wide variety of activities designed to improve students' leadership abilities and stimulate their interest in farming.

In addition to work with "in-school" students, vocational agriculture instructors provide organized instruction for young farmers, which deals primarily with their problems in establishing an enterprise, and for adult farmers to help them to keep abreast of modern farming technology.

Where Employed

Vocational agriculture departments exist in rural high schools throughout the United States and in Hawaii, Puerto Rico, the Virgin Islands, and Guam. The largest of these schools may have several instructors on the vocational agriculture staff.

Training and Other Qualifications

Vocational agriculture teachers must be graduates of a specialized course of training given in approved agricultural colleges. The training includes classes in both technical agriculture and teaching methods. Students must elect to enter this curriculum not later than their junior year in order to get the comprehensive training that is required for this field.

An in-service training program is conducted to keep vocational agriculture teachers abreast of new agricultural and teaching developments.

Employment Outlook

The employment outlook in the field of vocational agriculture is very good. There were approximately 11,000 teachers in this field in 1958 and the number is increasing gradually. Some turnover among teachers occurs constantly, some go into farming for themselves, others go into business or professional work related to agriculture, and still others retire or die. The number of high schools offering vocational agriculture courses has been increasing as has the number of schools that employ more than one teacher in this field.

Earnings

The vocational agriculture teacher has 12 months' employment each year and this is reflected in his annual salary. Beginning salaries in 1958 averaged around $4,400 and ranged from $3,400 to $5,000. Top salaries ranged from $5,500 in some States to $9,500 in others. The average salary for all teachers was about $5,200. In addition, vocational agriculture teachers in most

States are paid for official travel in supervising the programs of students and in carrying out other approved activities.

Where To Go for More Information

As salaries, travel, and programs of vocational agriculture teachers vary slightly among States, prospective teachers should consult with the Head Teacher Trainer in Agriculture Education at the land-grant college or the State Supervisor of Agricultural Education at the State Department of Public Instruction in their respective States.

(See also statement on Secondary School Teachers. Refer to index for page number.)

Agricultural Research Workers

Nature of Work

The number of research activities related to agriculture has increased rapidly within the last several decades. Although the largest agencies in this field are the State Experiment Stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture, many other research organizations exist. Some of these engage in independent research; others are connected with companies that produce chemicals, equipment, and other supplies for farmers, finance their operations, or market their products.

The major lines of research in connection with agriculture include the following: Entomology and parasitology, bacteriology, plant breeding and pathology, animal pathology, animal and poultry husbandry, soils research and conservation, agricultural engineering, economics of production, financing and marketing, human nutrition, and statistical analysis.

Entomologists develop control measures against insects affecting crops, people, animals, and marketed agricultural commodities and study the utilization of beneficial insects.

Bacteriologists conduct microbiological and fermentation research to produce vitamins, antibiotics, amino acids, sugars, and polymers, by the action of micro-organisms.

Plant pathologists conduct research on the causes and control of diseases attacking crop plants, including those caused by fungi, bacteria, viruses, and physiological conditions.

Soils researchers work on methods of controlling soil erosion and improving land use.

Agricultural engineers develop new machines, devise new processing techniques, and plan new types of buildings that are more efficient.

Agricultural economists deal primarily with complex problems related to the production and marketing of farm products. They are fact-finders, evaluators, analysts, and interpreters who help farmers with economic affairs.

Where Employed

The majority of research positions in agriculture are connected with the U.S. Department of Agriculture, although agricultural researchers also work for other government agencies and for private industry. Research positions with the U.S. Department of Agriculture are located in various parts of the country. A large number are in Washington, D.C., or at the nearby Agricultural Research Center at Beltsville, Md. There are also four Regional Research Laboratories at Albany, Calif.; Peoria, Ill.; Wyndmoor, Pa.; and New Orleans, La. Much of the research staff of the Department of Agriculture is stationed at land-grant colleges but there are also numerous other places where research units are located. Experimental work by staff members is conducted in Puerto Rico, Alaska, Hawaii, Mexico, France, Egypt, and other parts of the world. Many agricultural research jobs are found in other government departments.

Research workers associated with the experiment stations of the land-grant college system usually are stationed at the college, but many State colleges also have branch experiment stations at which specialized research is carried on; e.g., the branch station in Riverside, Calif., specializing in citrus research, the branch station at Stuttgart, Ark., specializing in research in rice production.

In 1958, approximately 8,000 research workers were employed in the land-grant colleges and about 6,000 in the U.S. Department of Agriculture. The business and other groups engaged in agricultural research probably employed an additional 8,000 workers. These figures include some research aides who are still working for their college degrees but who are also part-time employees on research projects. More than half of the research workers in land-grant colleges also spend part of their time in teaching.

Research by independent research organizations, foundations, and private business groups is developing in many parts of the country. These groups tend to be located either in industrial centers or in areas of high agricultural activity. These include producers of insecticides, herbicides, and other chemical dusts and sprays; producers of feed, seed, and fertilizer; and producers of mechanical equipment. Farm loan associations, banks, marketing associations, and other groups now employ research staffs to help guide their activities with farmers. It is estimated that approximately 2,000 such groups have agricultural research programs.

Training, Other Qualifications, and Advancement

College training is essential for research work today. The training of research workers is continually becoming more highly specialized. The field has become so broad that many colleges tend to specialize in particular lines of agricultural research work and training. The period of training is also lengthening, so that 5 or more years of college work are sometimes needed in order to attain the required proficiency.

Individuals who expect to enter this field of work should obtain a background in science and mathematics as early as possible. This will serve as a basis for making a decision as to which branch of research the student is best adapted to enter.

Although it is possible to enter most of these lines of research employment with a bachelor's degree, entrants should have in mind that they will probably have to go on to a master's and perhaps a doctor's degree in order to compete with other workers in the field.

Advancement for agricultural research workers depends on such considerations as the individual's productiveness, the quality of research, his ability to plan and organize research investigations, his ability to cooperate on investigative work, and the nature of his training.

Employment Outlook

The employment outlook in 1959 for agricultural research workers was good at all levels of training, and was expected to remain good for the next several years at least.

Agricultural colleges are unable to supply all the research workers needed in the field of agriculture. Science students must be recruited from other sources in order to fill the demand. Considerable competition exists between research agencies for workers with good potentialities, and the prospects are that this situation is likely to continue in the next few years.

Agricultural research has been a growing field of employment for several decades, as the value of research in agriculture has become increasingly recognized. Expenditures in support of such research by Federal and State Governments and by private organizations have increased in recent years, and this trend is expected to continue over the long run, creating employment opportunities for persons qualified to do research.

Earnings

Agricultural research workers frequently start as student assistants during the time they are obtaining their college training. Ordinarily, they are part-time workers who may be paid from $150 to $350 a month, depending on the amount of time they devote to their work. Others may do preprofessional work for the Department of Agriculture on a similar basis.

Entrance salaries for research workers on the staff of the Department of Agriculture depend on both educational attainment and experience. The usual scale is as follows:

	Beginning rating and salary
Bachelor's degree	GS–5 —$4,040
And a B or better average or in upper 25 percent of class	GS–7 — 4,980
Plus 1 year's experience	GS–7 — 4,980
Plus 2 years' experience	GS–9 — 5,985
Master's degree	GS–7 — 4,980
Plus 1 year's experience	GS–9 — 5,985
Doctor's degree	GS–11— 7,030

In some lines of work in which there is a shortage of workers, beginning salaries have been increased to $4,940 for GS–5 entrants, $5,880 for GS–7, and $6,885 for GS–9. Research workers now being paid at these higher rates include physicists, chemists, meteorologists, engineers (including agricultural engineers), metallurgists, geophysicists, electronic scientists, and mathematicians.

Top salaries in research work with the Department of Agriculture—about $14,000 to $17,500 annually—are paid to those people who combine research with administrative responsibilities.

Research workers in land-grant colleges sometimes are paid partly from Federal and partly from State funds, hence salaries vary from State to State. Actual cash salaries probably run slightly lower than those in the Department of Agriculture, but living costs may also run somewhat lower than in Washington, D.C., where many of the Federal jobs are located.

Where To Go for More Information

For additional information on research opportunities at land-grant colleges, contact the dean of agriculture at the land-grant college in your State. For information on employment in the U.S. Department of Agriculture, contact USDA recruitment representatives at the land-grant college or write directly to Office of Personnel, U.S. Department of Agriculture, Washington 25, D.C. For further information on research activities related to agriculture, see also statements on selected professional and technical occupations in this chapter and other chapters in this Handbook. (See especially chapter on the Biological Sciences. Refer to index for page numbers.)

The following publications will be valuable:

Career Service Opportunities in the U.S. Department of Agriculture, U.S. Department of Agriculture, Division of Employment, Office of Personnel, Washington 25, D.C.

1956–57 Opportunities for Employment in the Department of Agriculture, U.S. Department of Agriculture, Division of Employment, Office of Personnel, Washington 25, D.C.

I've Found My Future in Agriculture, American Association of Land-Grant Colleges and State Universities, Washington, D.C. 1958. Copies can be obtained from your State Agricultural College.

Agricultural Economists

(D.O.T. 0–36.11)

Nature of Work

Rapid changes in farm technology are creating new problems on both individual farms and in the economy as a whole. Farm operators are forced by economic competition to reorganize their enterprises so as to make the best use of new machines, new varieties of crops and livestock, and new methods. Increased farm production will complicate problems of marketing, prices, income distribution, and reorganization of productive efforts. In this broad field of study, the agricultural economist ordinarily works only in one special sector, for example, the marketing of livestock or of dairy products; the economics of producing eggs, broilers, or other farm products; the cost and return relationships in the application of fertilizer; the factors affecting the demand for soybeans, apples, or other types of farm products; cycles of cattle production and prices; the competitive position of cotton in the world market; or the price spread between the producer and the consumer of farm products.

The major fields of work of the agricultural economist are in research, teaching, and consultation. Some economists, however, use their training in economics as a background for farming or for business opportunities. They may do this either as operators or as specialized employees of large-scale farms, processing companies, or of organizations that provide goods and services for farmers. In the latter group are farm-implement companies; feed, seed, and fertilizer companies; chemical companies; banks; and farm loan agencies.

Where Employed

The State agricultural colleges employs the largest group of agricultural economists, to do research, teaching, and extension work. Many of these economists specialize in rather broad fields of study, such as farm management, production economics, prices, or marketing. The next largest employer of agricultural economists in the U.S. Department of Agriculture, which uses them in somewhat more specialized fields of inquiry, such as farm costs, land tenure, feeds and feeding, livestock production, poultry production, labor requirements, farm finance, crop estimates, marketing, merchandising methods, farm prices, disposal of farm surpluses, and improvement of incomes on small-scale farms. The Department also uses economists in much of its administrative and regulatory work.

Although these are the two largest employers of agricultural economists, many other organizations also employ such personnel. These include State Departments of Agriculture, Federal Reserve Banks, conservation and reclamation districts, farm cooperatives, and other farm organizations. To these may be added a long list of private concerns, such as banks, insurance companies, feed and fertilizer companies, farm machinery manufacturers, and packers of meat and other food products. Employment of agricultural economists in farming and by companies that provide services to farmers is constantly increasing. Many agricultural economists are now being called on for advisory work in connection with rural development programs in foreign countries. Some go on brief assignments to meet particular problems; others make foreign service in one or more countries a career.

Training

The person who qualifies for work in this field should have a minimum of a bachelor's degree with courses in both agriculture and agricultural economics. Practically all the land-grant colleges provide the special training that is needed; other colleges may also offer sufficient courses to provide an adequate foundation. The particular courses taken may depend on the type of work done but, in general, they should include work in production economics, statistics, farm management, marketing, farm finance, and land economics. This is a rapidly developing profession, and those who wish to progress in the more technical fields of agricultural economics should plan to continue their education toward the master's and doctor's degrees.

Employment Outlook

The current demand for well-qualified agricultural economists exceeds the supply. This situation is due partly to increased demands for people with this type of background in business, industry, and foreign service. At present, too, there are special projects in the United States Department of Agriculture that call for additional personnel. These include marketing research, rural development activities, and soil conservation reserve programs. The prospect is for continued expansion of this field. As agriculture becomes more commercial and technical, the need for trained economists becomes greater.

Approximately 3,000 agricultural economists were employed in this country in 1958, of whom about 1,500 were employed by land-grant colleges and the United States Department of Agriculture. Of these, about 750 were engaged in research while the rest were engaged in teaching, administrative, regulatory, and other types of work.

Earnings

The salaries of research workers employed by land-grant colleges and the U.S. Department of Agriculture have been discussed in the statement on agricultural research workers (p. 728). These will serve as a guide to entrance and average salaries of agricultural economists in the land-grant colleges and in the U.S. Department of Agriculture. Private companies frequently pay more. Positions in United States agencies in foreign countries ordinarily are at rates substantially above those for jobs in this country.

Where To Go for More Information

For additional information about opportunities in agricultural economics, check with the Department of Agricultural Economics in the land-grant college in your State. For information on Federal employment opportunities, get in touch with USDA Recruitment Representatives at your land-grant college or write directly to the Office of Personnel, U.S. Department of Agriculture, Washington 25, D.C.

(See also statement on economists. Refer to index for page number.)

Agricultural Finance Workers

Nature of Work

Credit has become an important aid to farmers in acquiring and operating farms. A large volume of long-term farm mortgage loans are made each year to assist farmers in buying, improving, and equipping farms. Similarly, a large volume of short-term or intermediate-term loans are made to farmers to finance current farm operations and to purchase livestock and equipment. A large share of these loans are made by commercial banks, life insurance companies, and specialized institutions that finance farmers.

In making loans to farmers, lending institutions need the services of men with broad training in agriculture and business. This training ordinarily requires practical farm experience as well as academic training in agriculture, economics, and other fields. Making loans on a sound basis involves careful analysis of the farm business and proper valuation of farm real estate and other farm property. Trained personnel in lending institutions, therefore, are the key to sound credit practices in financing farmers.

Where Employed

Farm Credit Institutions. The banks and associations that operate under the supervision of the Farm Credit Administration in Washington, D.C., are the major institutions that finance agriculture. Under this program the country is divided into 12 districts, with headquarters located in:

Springfield, Mass.	St. Paul, Minn.
Baltimore, Md.	Omaha, Nebr.
Columbia, S.C.	Wichita, Kans.
Louisville, Ky.	Houston, Tex.
New Orleans, La.	Berkeley, Calif.
St. Louis, Mo.	Spokane, Wash.

Each district has a Federal land bank, a Federal intermediate-credit bank, and a bank for cooperatives. These banks require men who are qualified to handle loans to farmers and, in the case of the banks for cooperatives, to farmers' cooperative associations. An important group of employees are the land appraisers who are paid by the Federal land banks but are in the Federal Civil Service and are appointed by the Farm Credit Administration. Also, in each district there are national farm loan associations through which land-bank loans are made and production credit associations which make short-term and intermediate-term loans to farmers. Throughout the country, there are approximately 500 production credit associations and 1,000 national farm loan associations.

Country Banks. In recent years, many country banks have employed men to handle loans to farmers and to maintain contacts with farmers. Usually, these men must have farm backgrounds and technical training in agriculture. Country banks all over the country are adopting the practice of employing agricultural specialists.

Farmers Home Administration. The Farmers Home Administration, with headquarters in Washington, D.C., makes real estate and production loans as well as certain emergency loans to farmers who cannot qualify for adequate credit from regular sources. In agricultural counties in most parts of the country, the Farmers Home Administration has a county supervisor who makes and services the loans in his territory. These men must have an agricultural background and training and be qualified to assist farmers in planning their farm business and in adopting proper farm practices.

Life Insurance Companies. Many of the major life insurance companies have substantial investments in farm mortgage loans and require men in their home offices as well as in the field to carry on the work of making and servicing loans. A technical background in farming is desirable for these positions.

Training, Other Qualifications, and Advancement

In the field of agricultural finance, practical knowledge of farming, as well as technical training in agriculture, is desirable. To qualify for such positions, therefore, a man should acquire practical experience in farming and preferably take a 4-year course at an agricultural college. The curriculum should provide training in agricultural economics, including courses in farm management, farm finance, land economics, marketing, and accounting. Technical courses in crop and livestock production and soil management are also important.

In many instances, it will be necessary for young men to enter agricultural credit institutions as trainees or to begin in loan associations as field representatives or assistant secretary-treasurers. From these positions, they will have opportunities to advance to the higher positions in district credit institutions and to positions as secretary-treasurers (managers) in national farm loan associations and production credit associations. Men selected for agricultural work in country banks ordinarily must have had previous experience, such as work in agricultural extension or other work with farmers.

Employment Outlook

While the total number of persons employed in agricultural finance is not particularly large, there are career opportunities for a fairly large number of men desiring to enter this field. Agriculture is becoming more technical and the capital invested per farm is increasing materially. Thus, financing of farms is becoming more technical and requires greater skill. In the future, greater emphasis will be placed on technical training as a qualification for positions in this field.

Earnings and Working Conditions

No standard pattern of salaries prevails in the agricultural finance field. For example, among national farm loan associations and production credit associations, there is a wide range in the volume of loans and in the financial position of the associations, and this influences the number of employees and the salaries paid. The salaries paid to secretary-treasurers of these associations range from approximately $3,000 to $12,000; a large proportion of the secretary-treasurers receive salaries that range from $5,000 to $8,000. County supervisors under the Farmers Home Administration receive salaries that range approximately from $3,600 to $6,200 per year, with an average of approximately $5,000. Salaries paid by country banks differ even more widely.

Working conditions in the field of agricultural finance generally are attractive. The banks and associations are located in the larger cities and the larger country towns in agricultural areas where living conditions generally are favorable. The work requires travel in the field to contact farmers, and this work is usually pleasant and constructive.

Where To Go for More Information

Inquiries on opportunities for employment in the field of agricultural finance may be directed to the following:

Farm Credit Administration, Washington 25, D.C.

Farm Credit District—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita, Kans.; Houston, Tex.; Berkeley, Calif.; Spokane, Wash.

Farmers Home Administration, U.S. Department of Agriculture, Washington 25, D.C.

Agricultural Director, American Bankers Association, 12 East 36th St., New York 16, N.Y.

(See also chapters on Banking Occupations and Insurance Occupations. Refer to index for page numbers.)

Agricultural Engineers

(D.O.T. 0–19.10)

Nature of Work

During the last two decades, the efforts of agricultural engineers have been directed largely to the engineering design of tractors and farm equipment, design of farm structures, utilization of electrical energy on farms, soil and water conservation and management, and processing of agricultural products for the market. In these specialties, the agricultural engineer uses basic engineering principles and concepts to help achieve greater production per farmworker with fewer man-hours per unit of produce, at a greater return to the farmer and improved quality for the consumer. Specific areas of work involve research, education, production, design, development, testing, and application, production engineering, sales engineering, maintenance, management, or some combination of these.

Where Employed

Private business organizations employ approximately 60 percent of the agricultural engineers in the United States and the rest are engaged in public service work.

Agricultural engineers are employed by more than 1,000 private business organizations, ranging from very large manufacturers to individually owned small businesses. These include farm-equipment manufacturers who produce tractors and related farm equipment; smaller and more specialized manufacturers of field, barnyard, and household equipment; producers of electrical, mechanical, and structural component parts and basic component materials having agricultural applications; electric service companies; distributors and dealers in farm equipment and supplies; trade associations; specialized agricultural producers and processors; publishers; advertising agencies; consulting engineers; and engineering and management services for farmers. Some agricultural engineers are self-employed as owners or partners in some of the above types of business.

Among government agencies, the U.S. Department of Agriculture is the largest single employer with the Department's Soil Conservation Service and the Agricultural Research Service the largest users of agricultural engineers. The U.S. Department of the Interior and the Department of Defense employ smaller numbers, and several other Federal agencies each use a few. Individual States also employ agricultural engineers, most of whom are affiliated with the agricultural engineering departments of the State colleges, universities, experiment stations, and extension services. Some are employed by other State agencies concerned with natural resources, food sanitation, pollution control, highways, soil conservation, and other work related to State interests in public welfare, business, and agriculture. A few agricultural engineers work for counties, cities, and special districts organized on the basis of drainage, irrigation, public power, and soil conservation problems.

Employment Outlook

In addition to the immediate shortage of well-qualified agricultural engineers, several factors contribute to favorable long-range employment outlook for agricultural engineers in a broadening field. The market for agricultural products will increase with population. Broadening use of agricultural products and wastes as industrial raw material will create new openings for engineers. Also, engineers have proved their worth, especially in improving man's capacity to deal effectively and economically with the high tonnages, large volumes, tremendous energies and power requirements, accurate environmental controls, and precision operations that are characteristic of the modern farm. These major factors in the cost and quality of agricultural production are open to much further improvement through agricultural engineering. They present major opportunities for additional engineering service to agriculture.

The agricultural engineer looks forward to growing opportunity to make farmwork easier, more productive, and more economical. He can use the whole range of physical and biological sciences to tool up agriculture so as to insure the more complete development and realization of human resources. He can contribute also to wider use of methods which conserve soil and water resources.

Training and Other Qualifications

More than 40 State colleges offer professional training in agricultural engineering leading to a bachelor of science degree. A few others offer similar training with degrees in other branches of engineering. Most of them also offer graduate training leading to the M.S. degree, and a few provide opportunities for qualified students to earn the doctor of philosophy degree. A degree in agricultural engineering is frequently required by employers for work in this field. For some jobs and some employers, training in another branch of engineering, together with some knowledge of agriculture, is acceptable.

Earnings

Agricultural engineering salaries are comparable with those in other branches of engineering. As in other engineering fields, salaries of agricultural engineers are affected greatly by training, experience, and proved ability. Salaries for qualified senior engineers range from about $8,000 to $12,000. Salaries are much higher for chief engineers and engineers who have advanced to executive or managerial positions.

Where To Go for More Information

Information on schools may be obtained from:

State Agricultural Colleges.

The American Society of Agricultural Engineers, St. Joseph, Mich.

Information on Federal employment may be obtained from:

United States Civil Service Commission, Washington 25, D.C.

Office of Personnel, U.S. Department of Agriculture, Washington 25, D.C.

Local county offices of the Soil Conservation Service, U.S. Department of Agriculture.

(See also chapter on Engineers. Refer to index for page number.)

Soil Scientists

(D.O.T. 0–35.03)

Nature of Work

Soil scientists are trained to determine the physical, chemical, and biological characteristics and behavior of soils. They investigate soils in the field and in the laboratory and classify them into homogeneous units in accordance with a national system of soil classification. From the study of their characteristics and through research, soils can be defined in terms of their responses to management practices and capabilities for producing crops, grasses, and trees, as well as their behavior as engineering materials. Soil scientists prepare maps, usually based on aerial photographs, on which the individual kinds of soil and other landscape features significant to soil use and management are plotted accurately in relation to land lines, field boundaries, roads, and other conspicuous features.

Soil scientists also conduct research to determine the physical and chemical properties of soils and their water relationships in order to understand their behavior and origin. They predict the yields of cultivated crops, and of grasses and trees, that can be produced under alternative combinations of management practices, both extensive and intensive.

The field of soil science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science also fit individuals for positions as farm managers, plantation managers, land appraisers, and many other professional positions.

Where Employed

Most soil scientists are employed by agencies of the Federal Government, State experiment stations, and colleges of agriculture. However, many soil scientists are employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State highway departments, State and city park departments, State conservation departments, and farm management agencies throughout the United States and its Territories. A few operate independent consulting businesses. An increasing number of American soil scientists are employed as research leaders, consultants, and agricultural managers in foreign countries.

Training and Advancement

Training in a college or university of recognized standing is important in obtaining employment as a soil scientist. A B.S. degree is a minimum requirement for entrants in this field. Those with graduate training, especially with a doctor's degree, can be expected to advance rapidly into responsible positions with good pay. This is particularly true in soil research, including the more responsible positions in soil classification, and in teaching. Soil scientists who are able to deal with both field data and laboratory data have a special advantage.

Many colleges and universities offer fellowships and assistantships for graduate training or employ students for part-time teaching or research.

Employment Outlook

Opportunities for well-trained soil scientists were good in 1958; they are expected to continue for several years. A number of positions are vacant now because of the shortage of qualified soil scientists.

There is increasing demand for soil scientists to help complete the scientific classification and evaluation of the soil resources in the United States. One of the major program objectives of the Soil Conservation Service of the U.S. Department of Agriculture is to complete the soil survey of all rural lands in the United States. This program includes research, soil classification and correlation, the interpretation of results for use by agriculturists and engineers, and the training of others in the use of the results Also, demand is increasing for both basic and applied research to increase the efficiency of soil use on a sustained basis.

Earnings

The income of soil scientists depends upon the amount of responsible work they can do. This in turn depends upon their educational background, professional experience, and individual abilities.

Entrance salaries in the Federal service for soil scientists with a B.S. degree are approximately $4,490 per year, with advancement to $4,980 after 1 year of satisfactory performance. Beyond that, advancement depends upon the ability of the soil scientist to carry on high quality work and to accept responsibility. Earnings of well-qualified soil scientists with several years' experience range from $8,000 to $12,000 per year.

Where To Go for More Information

Additional information may be obtained from the U.S. Civil Service Commission, Washington 25, D.C.; Office of Personnel, U.S. Department of Agriculture, Washington 25, D.C.; or any office of the Department's Soil Conservation Service.

(See also statement on Chemists and Biologists. Refer to index for page numbers.)

Soil Conservationists

(D.O.T. 0-35.03)

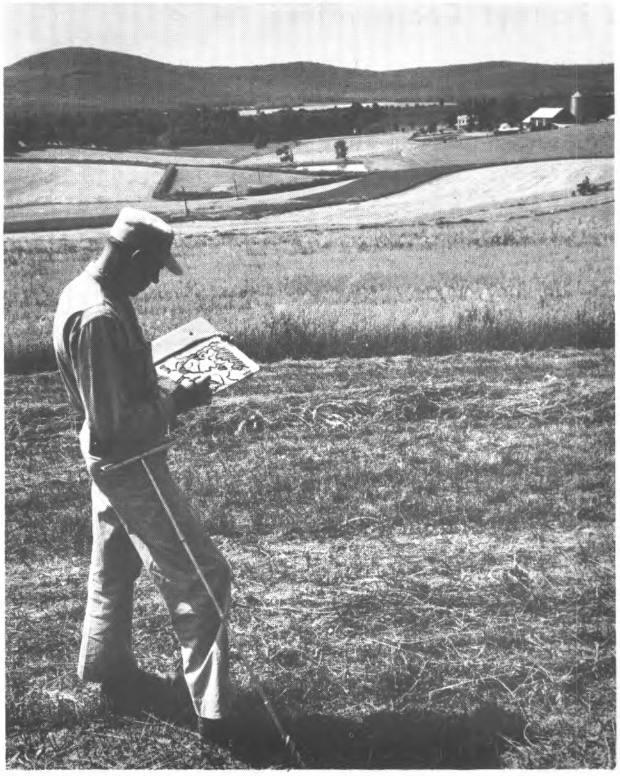
Nature of Work

Soil conservationists are trained to give farmers, ranchers, and others technical assistance in planning, applying, and maintaining soil and water conservation measures and structural improvements on individual holdings, groups of holdings, or on watersheds. Farmers and other managers of land apply this technical assistance by making adjustments in land use; protecting land against soil deterioration; rebuilding eroded and depleted soils; stabilizing runoff and sediment-producing areas; improving cover on crop, forest, pasture, range, and wildlife lands; conserving water for farm and ranch use and reducing damage from flood water and sediment, and by draining or irrigating farms or ranches.

The land owner or operator has the responsibility for resolving problems concerning land use and treatment raised by his farm or ranch conservation plan. In reaching his decisions, however, he can take advantage of the reliable technical information which the soil conservationist can provide. These technical services are as follows:

1. Maps presenting inventories of soil, water, vegetation, and other details that are essential in conservation planning and application.
2. Information on what the proper land uses are and what treatment is suitable for the planning use of each field or part of the farm or ranch, groups of farms or ranches, or entire watersheds.
3. The relative cost of, and expected returns from, various alternatives of land use and treatment.

After the landowner or operator decides upon a conservation program that provides for the land to be used within its capability and treated according to the planned use, the relevant facts are recorded in a plan which, together with the maps and other supplemental information, constitute a *plan of action* for conservation farming or ranching. The soil conservationist then gives the land manager technical guidance in applying the conservation practices and in maintaining them.



COURTESY OF U.S. DEPARTMENT OF AGRICULTURE

Soil conservationist preparing a use-capability soil map for a farm.

Where Employed

Most of the soil conservationists are hired by the Federal Government, mainly by the U.S. Department of Agriculture's Soil Conservation Service and the Bureau of Indian Affairs in the Department of Interior. Some are employed by colleges and State and local governments; others work for banks and public utilities.

Training and Advancement

A bachelor's degree is the minimum requirement for professional soil conservationists. A college degree is not required for subprofessional soil conservationists whose primary work is that of giving farmers or ranchers assistance in applying conservation practices after conservation planning has been done.

Thorough training in a college or university of recognized standing, however, is necessary in securing employment as a professional soil conservationist. Those with degrees in the following specialties are eligible to become soil conservationists after special field training in farm and ranch conservation and land use planning: forestry, biology, agronomy, engineering, range, and general agriculture.

Professional soil conservationists who show unusual aptitude in the various phases of the work have good chances of advancement into higher salaried technical and administrative jobs.

Employment Outlook

Employment opportunities for well-trained soil conservationists were good in 1958. There are frequent openings in most parts of the country because of the normal turnover in personnel. Opportunities in the profession will expand because of increasing interest in conservation by Government agencies, public utility companies, banks, and other organizations which are adding conservationists to their staffs. It is likely that there will be a number of new openings in this field in college teaching, particularly at the undergraduate level.

Earnings

The entrance salary for soil conservationists with a B.S. degree employed by the Federal Government is approximately $4,040 per year, with advancement to $4,980 after 1 year of satisfactory service. Subsequently, advancement depends upon the individual's ability to advance to positions of greater responsibility. The top salaries in this field in the Federal Service range from $12,000 to $14,000 per year.

The entrance salary in private employment depends upon the individual's education and experience, with the upper limits set by his ability and initiative.

Where To Go for More Information

Additional information on employment as a soil conservationist may be obtained from the U.S. Civil Service Commission, Washington 25, D.C.; Employment Division, Office of Personnel, U.S. Department of Agriculture, Washington 25, D.C.; or any office of the Department's Soil Conservation Service.

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Management Positions in Farmer Cooperatives

Nature of Work

Farmer cooperatives operate much like other businesses but differ in that they are owned, controlled, and operated by and for their member patrons. Through cooperatives, farmers market their products, purchase farm supplies, and obtain farm business services such as credit, electricity, telephone, insurance, and irrigation more conveniently and economically than they could if operating as individuals. Like other businesses, farmer cooperatives are seeking efficient managers and other capable personnel.

The basic philosophy of a cooperative differs to a marked degree from that of other types of corporate endeavor in that it stresses services and increased returns for patrons rather than profits for the firm. At the same time, the cooperative uses, with certain exceptions, exactly the same talents and professional training called for by other business firms. To the employees involved, working for a cooperative means salaries and work assignments substantially the same as those of employees in other types of firms.

The number of employees in any cooperative, the nature of their jobs, and their responsibilities depend upon the size of the cooperative and the services offered. Large farm supply cooperatives, for example, may have separate divisions for feed, seed, fertilizer, petroleum, chemical, farm machinery, public relations, and credit, each supervised by a department head. These department heads are responsible in turn to the general manager. In smaller cooperatives, such as local grain marketing elevators, the business is run almost entirely by the general manager with only two or three helpers.

The members of the cooperative elect their own directors who, in turn, employ the general manager as the executive officer of the cooperative. He acts under authority delegated to him by the board of directors and is called upon to make decisions within the framework of policies established by the board.

Successful management requires a broad knowledge of the general business coupled with an overall understanding of the operations of all departments of the cooperative. For example, the general manager must exercise his best judgment in the purchase, sale, or processing of commodities handled by the association. He must be a judge of markets as well as business conditions. He must have a knowledge of finances as well as credit control. He is frequently called upon for advice and asked to participate in community projects. Generally, although not always, top management of a cooperative moves up from the accounting, professional, or sales occupations staffs.

Training and Other Qualifications

In selecting people to staff their associations, especially those to be trained for supervisory positions, farmer cooperatives have shown a marked preference in recent years for college graduates. However, any outstanding employee with necessary experience will be considered for promotion and sometimes given management training, even though he has only a high school education. Some cooperatives have established scholarship programs to provide for the education, in whole or in part, of carefully selected students. Under some of these programs, the students chosen spend their summers working for the cooperative.

Specialized college education is seldom required for cooperative management trainees. However, courses in agricultural economics, finance, marketing, statistics, political science, commercial law, and accounting are most helpful. Courses in English and public speaking are also good preparation. Although it is not a prerequisite, a farm background is often desirable.

Many cooperatives offer in-service training programs designed to orient the employee and give him the "feel" of the cooperative. They may run from a few days to a few weeks. Training programs of this kind are helpful in determining in what work the employees are most useful to the organization.

Employment Outlook

College graduates and other well-trained invividuals who possess the qualifications needed by farmer cooperatives will continue to be in demand in the foreseeable future. Farmer cooperatives are growing in size and increasing the scope of their operations. New positions that call for specialized training will arise from this cooperative expansion and the trend toward agricultural integration. However, as in other businesses, the usual source of openings will come from normal employee turnover caused by retirements, deaths, and resignations.

Farmer cooperatives are located in every State. For information relating to job opportunities in farmer cooperatives, contact the local or regional cooperatives in your home community first. If these have no positions open, they may be able to refer you to other cooperatives that do. Other sources of cooperative information are the county agent and the Agricultural Economics Departments of the State Agricultural Colleges. General information may also be obtained from the American Institute of Cooperation or the National Council of Farmer Cooperatives, both located at 744 Jackson Place N.W., Washington, D.C., and the Cooperative League of the U.S.A., 343 South Dearborn St., Chicago 4, Ill.

Other Professional Workers

There are numerous other professional opportunities for people trained in agriculture but they are discussed below in less detail. These opportunities include: Inspection, grading, and marketing of farm products; work with agencies that prevent the spread of plant pests, animal parasites, and diseases; management of organizations of farmers, and large scale farms or ranches; organization of farm management and other professional services for farmers; wildlife management and control; and agricultural communications.

The qualifications of workers in these fields ordinarily include a college education with special training in the particular line of work. Inspectors of fruits and vegetables and workers engaged in pest control ordinarily must be qualified as entomologists or parasitologists, inspectors of dairy products as bacteriologists, and inspectors of meat and poultry products as veterinarians. They work with marketing specialists who interpret and enforce marketing agreements and regulations. Preparation for many professional jobs in agriculture calls for training in agricultural economics. The management of the individual farm enterprise is also facilitated by work in agricultural economics.

Another growing field of specialization is that of agricultural communications. A staff of market news reporters is employed by the U.S. Deparment of Agriculture in 125 field offices over the United States to report on the movement of agricultural produce from the farm to the market. Radio farm directors are employed by many radio stations to report prices, sales, grades, and other agricultural information to farm people. Agricultural reporters and editors compile and publish a wealth of farm news and data for farm journals, farm bulletins, and farm broadcasts.

The demand for workers in most of these fields exceeds the supply. In recent years, the demand has been increased by the recruitment of professional personnel to staff agricultural missions to give technical aid to farmers in other countries.

Farm Service Jobs

In almost every type of agriculture, there are specialized services which an individual can learn readily and perform for farmers. A person can enter many of these either as an employee or as an independent operator. Some of these services require an extensive outlay of capital but others require very little. Some are highly seasonal whereas others can be rendered the year-round. These services can sometimes be combined well with the operation of a small farm.

Services that provide employment on a year-round basis include the following: cow testing, artificial breeding service, whitewashing service, livestock trucking, and well drilling.

In cow testing and artificial breeding work, an association of farmers employs one or more workers on a monthly basis to conduct the operations. Supervisors who do cow testing are employed by dairy herd improvement associations. They must have a high school education, and a farm background is almost essential. In 1958, annual salaries ran from about $3,000 to 4,200. Artificial breeding associations employ inseminators who must have at least a high school education. In 1958, these workers were paid from about $4,800 to $7,200 a year. Agricultural college training is desirable but not essential for employment in these occupations. Brief periods of approximately a month of specialized training for these occupations are available through the associations. Individuals ordinarily set up the whitewashing, trucking, and well-drilling services and employ such assistants as they need.

Other services performed for farmers are of a more seasonal nature. These include: Fruit spraying (2–3 months), airplane dusting (4–6 months), grain combining (2 months), hay and straw baling (2–8 months), tractor plowing and cultivating (4–6 months), and sheep shearing (2–3 months).

These and many other services are often done by farmers who wish to keep their equipment busy and therefore engage in custom work as a sideline. In areas with a long growing season, however, the period when these services can be carried on will be long enough to permit individuals to specialize in them.

Somewhat more remote from farm operation but still closely tied in with agriculture are such vocations as: Repair and servicing of farm machinery; feed grinding and mixing; storage and warehousing of agricultural products; operation of nurseries and greenhouses; and packing, grading, and processing of farm products.

These activities are sometimes performed on the farm, but the tendency has been for them to move away from the farm and be carried on as specialized lines of business. An agricultural background is helpful to people who enter these lines of work. The agricultural aspects can be learned more readily than the specialized skills that are required in these lines of work.

Occupations in Government

Government service offers employment opportunities to many thousands of workers annually in a great variety of occupational fields. It is one of the Nation's largest fields of employment.

One worker out of every eight in the United States—about 8 million persons in early 1959—was employed at some level of government—Federal, State, or local. (In addition, about 2.6 million persons were serving in the various branches of the Armed Forces.) Local government, with its more than 100,000 units, employed more than 50 percent of all government workers. State governments accounted for nearly one-fifth of public employment and the Federal Government accounted for the remainder.

Government jobs are to be found not only in every State, county, and city, but even in smaller communities; in lonely lighthouses off the sea coasts; and in forest ranger stations at the tops of high mountains. In every State, government workers constitute a significant part of the work force, ranging from about 9 percent to nearly 20 percent of total employment.

Government employment represents an important source of job opportunities for women. About 40 percent of all government employees are women, most of whom are employed in clerical and teaching jobs.

Government Activities and Occupations

The leading function of government, in terms of employment, is to provide educational services. (See chart 52.) More than 2.5 million persons, about one-third of all government workers, were engaged in this field in late 1958. More than 83 percent of these workers were employed in elementary and secondary schools, largely administered by local governments. Employment in the field of education is not confined to teachers or professional staffs, but also includes administrative, clerical, maintenance, and auxiliary employees.

The second largest group of government workers—about 1,000,000, or approximately 13 percent of the total—were engaged in national defense activities of the Federal Government. This group included the civilian employees of the Department of Defense and a few other defense-related agencies such as the Atomic Energy Commission. They include administrative and clerical employees, scientists and engineers, manual workers in navy yards and arsenals, employees of military hospitals and of schools run by the military services, and a wide variety of other kinds of workers.

Other large concentrations of employment were in health services and hospitals (almost 800,000), the postal service (540,000), 530,000 in highways, and 580,000 in general control functions. (General control functions include the activities of governmental chief executives and their staffs, legislative bodies, the administration of justice, tax enforcement, and other financial activities, and general administration.) Other activities, none of which accounts for more than 5 percent of total government employment, are housing and community development, police and fire protection, public welfare services and assistance, transportation and public utilities, social security, and conservation of natural resources.

Most of the government workers in the health and hospital fields, highway work, and police and fire protection activities are employed by State and local government agencies. On the other hand, the postal service is Federal, and so are most of the jobs concerned with natural resources, such as those in the National Park Service.

These diverse functions require the services of employees in many different occupations. Every major group of occupations found in nongovernmental work, even a few sales workers and farmers, have their counterpart in governmental work. Because of the special character of many government activities, the occupational distribution of employment is very different from that found in private industry, as can be seen from the following tabulation:

	Percent of— Government workers in the U.S.[1]	Percent of— Total employed workers in the U.S.[2]
All categories	100.0	100.0
Professional and technical	31.4	9.9
Managerial, proprietorships, and officials	5.8	10.3
Clerical	23.4	14.1
Sales	.2	6.4
Craftsmen	9.6	13.3
Operatives	6.9	19.3
Service workers	17.3	11.7
Laborers	5.4	5.7
Farmers and farm workers	(3)	9.3

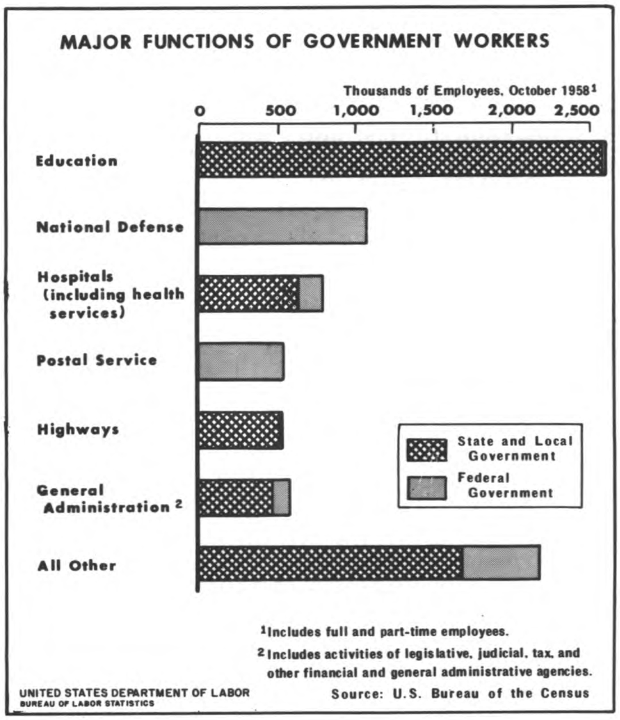
[1] Based on 1957 estimates of employment, U.S. Department of Labor.
[2] U.S. Department of Commerce, Bureau of the Census, The Monthly Report on the Labor Force: 1957.
[3] Less than 0.05 percent.

A majority of government workers, numbering more than 4 million in 1958, was employed in professional and technical, managerial, sales, and clerical occupations, i.e., the so-called "white collar" jobs. Important occupational groups among the white-collar workers were the teachers, postal clerks, and office workers such as stenographers, typists, and clerks. Among the more than 3 million service and manual workers, some important occupational groups were aircraft and automotive mechanics and repairmen, policemen, firemen, truckdrivers, skilled maintenance workers (including carpenters, painters, plumbers, and electricians), custodial workers, and laborers.

The relative occupational distribution of workers within the broad divisions of government—Federal, State, or local—varies considerably. Moreover, the occupational pattern of employment may change rapidly, reflecting significant shifts in governmental responsibilities.

The kinds of occupations or occupational fields, as well as employment trends, found in the major divisions of government (Federal, State, and local) are discussed separately in the following pages. This chapter also contains a discussion of the occupational fields in the various branches of the Armed Forces.

CHART 52



Civilian Employment in Federal Government

The Federal Government employs more workers than any other single employer in the United States. In early 1959, its establishments in the 49 States and the District of Columbia employed about 2,200,000 civilian workers—about 4 percent of all nonagricultural workers in the Nation. Almost all Federal workers, about 99 percent in 1958, were employed by the 75 departments and agencies which make up the Executive Branch. The other 1 percent of the Federal civilian workers were employed in the Legislative and Judicial Branches.

The Executive Branch is responsible for such services as: Maintaining the flow of supplies and equipment to the Armed Forces; delivering mail; conducting scientific research; conserving natural resources; enforcing Federal laws; handling international relations; treating and rehabilitating disabled veterans; and administering other programs aimed to promote the health and welfare of the American people.

Most Federal workers are employed by two Departments—the Department of Defense and the Post Office Department. In early 1959, about 1.5 million workers, or about 70 percent of all Federal employees were to be found in these two agencies. The Department of Defense, which includes the Departments of the Army, Air Force, and Navy, employed approximately 44 percent (954,000) of all workers in the Executive Branch, and was the largest employer. The Post Office Department, with 540,000 employees, accounted for about 25 percent of all Federal employment.

The Veterans Administration, with more than 170,000 employees, is the only other agency in the Federal Government having more than 100,000 workers. The other civilian Executive Branch employees are distributed among approximately 70 departments and agencies which handle the many other services performed by the Federal Government. Employment in these agencies range from fewer than 100 in a small agency to more than 50,000 employees in the large ones. Among the larger employers are the Departments of Agriculture; Treasury; Health, Education, and Welfare; and Interior.

The Legislative and Judicial Branches have relatively few employees. In 1958, these two independent branches of the Federal Government employed about 22,000 and 5,000 workers, respectively.

Civilian employees of the Government are engaged in most of the occupations that are also found in private industry—accounting, engineering, medicine, law, stenography, mechanical trades, and truckdriving, to cite a few illustrátions. Many workers, however, are employed in occupations unique to the Federal Government, such as border patrolman and postal clerk.

According to a study conducted by the U.S. Civil Service Commission, there were more than 500 white-collar occupations in the Federal Govermnent in February 1957. At that time, the nearly 1,400,000 full-time white-collar workers in the continental United States accounted for approximately 63 percent of total Federal employment. The remainder, more than 675,000 workers, were employed in a wide range of manual and service occupations in 1957.

About 753,000 (54.1 percent) of the white-collar workers were in general administrative or clerical and office service positions which include most postal employees. Three other occupational groups—accounting and budget, medical, and supply—with 93,000, 81,000, and 74,000 workers, respectively, each had more than 5 percent of all white-collar employees. The other white-collar workers were employed in a wide variety of fields such as engineering, investigation, legal work, biological and physical sciences, personnel administration and industrial relations, and transportation.

Postal employees, who comprised approximately one-fourth of all white-collar workers formed the largest single group of Government workers. These workers sort and deliver the mail, sell postage stamps and money orders, and supervise the operation of the post offices.

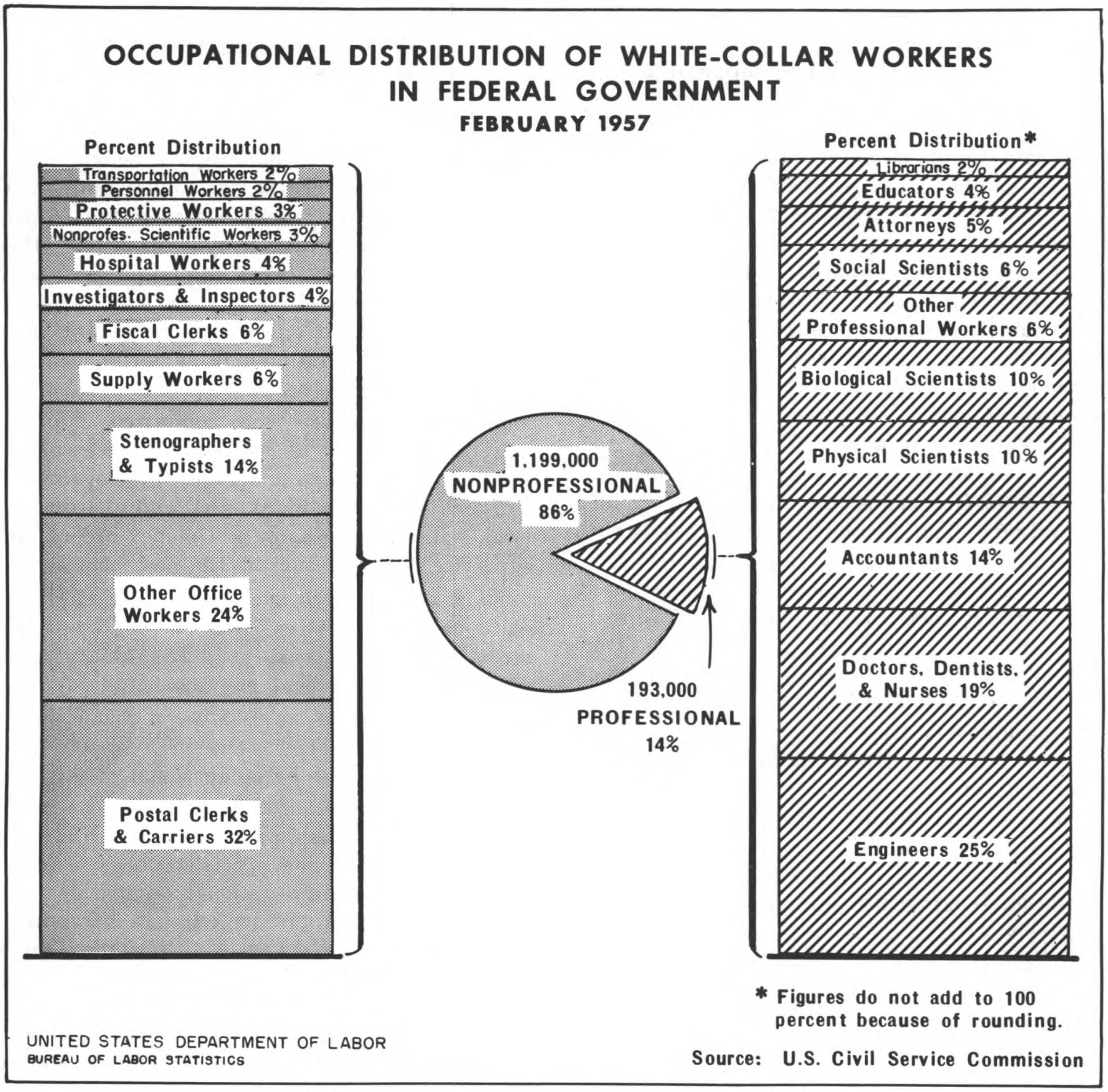
Other officeworkers, such as secretaries, clerks, office machine operators, telephone operators, and receptionists, also constituted a significant proportion of Government employment.

Chart 53 shows the relative distribution of Federal white-collar workers in February 1957 in the United States by occupational group.

About 14 percent of the white-collar workers were in "professional" occupations which usually require more education, specialization, and training than most nonprofessional occupations. A majority of the approximately 195,000 professional workers were engaged in three broad areas of work: Engineering; medical, including hospital, dental, and public health; and accounting and budgets. The largest occupational group, nearly 50,000 workers, were engineers. The more than 36,000 doctors, dentists, and nurses, constituted the second largest professional occupational group. Significant numbers were also employed as accountants, biological scientists, physical scientists, social scientists, attorneys, educators, mathematicians and statisticians, and librarians.

In addition to the many white-collar occupations in the Federal Government, approximately 600,000 Federal workers were employed in many different manual and service occupations in early 1959. The bulk of these "blue-collar" workers

CHART 53



were to be found in Federal establishments such as naval shipyards; arsenals; air bases; quartermaster depots; construction projects; and harbor, flood-control, irrigation, or reclamation projects. More than 80 percent of all manual and service workers were employed by the Department of Defense. Within the Department of Defense, the Department of Navy, with about 200,000 employees, was the largest employer. The Department of Army, with almost 145,000 workers, and the Department of Air Force, with more than 140,000, also employed substantial numbers of these workers. Most of the remaining employees were engaged in activities of the Veterans Administration, the General Services Administration, the Department of Interior, the Tennessee Valley Authority, and the Department of Agriculture.

The following tabulation, from a February 1957 study by the U.S. Civil Service Commission, illustrates the wide range of manual and service occupations found among the more than 675,000 full-time blue-collar workers in the Federal Government in the United States:

Occupation	Blue-collar workers in continental United States	Percent of total [1]
Total, all groups	676, 378	100. 0
Manual labor	88, 002	13. 0
Mobile industrial equipment operation and maintenance	80, 150	11. 8
Warehousing	57, 466	8. 5
Fixed industrial equipment operation and maintenance	50, 838	7. 5
Services	43, 394	6. 4
Aircraft repair, propeller work, and engine overhaul	43, 049	6. 4
Metal work	42, 312	6. 3
Machine shop work	38, 385	5. 7
Electrical installation and maintenance	33, 599	5. 0
Woodworking	26, 386	3. 9
Marine work	25, 396	3. 8
Armament and ammunition work	21, 635	3. 2
Electronic equipment installation, maintenance, and operation	21, 214	3. 1
Pipefitting	16, 905	2. 5
Painting	15, 905	2. 4
Printing and reproduction	15, 022	2. 2
Packing and processing	14, 414	2. 1
Fabric, leather, fur, and textile work	7, 108	1. 1
Manufacture and repair shop operation	6, 818	1. 0
Instrument maintenance	6, 562	1. 0
Construction and maintenance	6, 323	. 9
Wire communications equipment installation and maintenance	2, 884	. 4
Masonry, plastering, and roofing	2, 394	. 4
Railroad operation and maintenance	2, 391	. 4
General equipment maintenance	2, 278	. 3
Rubber work	1, 017	. 2
Animal caretaking	526	. 1
Plastic work	420	. 1
Motion picture, radio, television, sound recording equipment work	341	. 1
Reclamation work	312	(2)
Optical work	306	(2)
Quartz crystal work	248	(2)
Glass work	145	(2)
Quarry work	82	(2)
Film processing	12	(2)
Miscellaneous occupations, not elsewhere classified	2, 139	3

[1] Because of rounding, sum of items may not equal totals.
[2] Less than 0.05 percent.

About 70 percent of all blue-collar employment was concentrated in nine occupational fields. Two occupational groups, manual labor and mobile industrial equipment operation and maintenance (i.e., mainly truckdriving, construction equipment operation, and vehicle and equipment maintenance) accounted for 25 percent of total blue-collar employment.

Among individual manual and service occupations, laborers comprised the largest single group. Other occupations with large numbers of workers were made up of automobile and aircraft mechanics, carpenters, cooks, construction machinery and equipment operators, electricians, electronic technicians, machinists, painters, plumbers, printing pressmen, sheet-metal workers, stationary engineers, steamfitters, truckdrivers, and waiters.

Detailed description of the work duties for most "white-collar" and "blue-collar" occupations mentioned above are to be found in other sections of this Handbook. They may be located by referring to the occupational titles in the Index.

Federal employees are stationed in all parts of the United States, in its territories and possessions, and in many foreign countries. While most Government departments and agencies have their headquarters offices in the Washington, D.C., metropolitan area, only about 1 out of 10 Federal workers was employed in this area in 1958. The State of California, with almost 240,000 Federal employees had somewhat more than the Washington, D.C., metropolitan area. Other States with more than 100,000 workers included New York (189,000), Pennsylvania (136,000), and Texas (120,000).

The Merit System

About 86 percent of the jobs in the Federal Government in early 1959 were covered by the Civil Service Act. This act was passed by Congress in order to insure that hiring is done on the basis of individual merit. It provides for competitive examinations and the selection of new employees from among those who make the highest scores. The Civil Service Commission administers the Civil Service Act. In this capacity, it is responsible for examining and rating applicants and supplying Federal departments and agencies with names of persons who are eligible for the jobs to be filled.

Many Federal jobs are excepted from Civil Service requirements either by law or by action of the Civil Service Commission. However, a large percentage of the excepted positions are under separate merit systems of other agencies, such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Atomic Energy Commission, and the Tennessee Valley Authority. These agencies establish their own standards for the selection of new employees.

Civil Service competitive examinations may be taken by all persons who are citizens of the United States, or owe allegiance to the United States. To attain eligibility for appointment an applicant must meet requirements for the particular position as to age, physical ability, training, and experience. Examinations vary according to the types of positions for which they are held. Some examinations include written tests; others do not. In nonwritten examinations, applicants are rated according to their training, experience, and skills as shown by their applications and any corroborating evidence required by the Commission.

Examinations are given for a great variety of jobs either at the entrance grades or at higher levels, depending upon the current needs of the Government. In a given period, for example, examinations may be open for clerk-typists, accountants and auditors, agricultural marketing specialists, offset pressmen, and research chemists.

An examination for persons with college training—the Federal Service Entrance Examination—is given to fill entrance positions in a wide range of occupations and professions. This assembled, or written examination is given periodically during the school year, from fall to spring. It is open to college graduates, college juniors and seniors, or persons who can qualify through experience or a combination of education and experience. The Federal Service Entrance Examination is used to fill entrance or trainee positions in which the employee's potential for development is considered more important than special training for the work. Thus, a person who passes the examination may be considered for entrance-level professional, administrative, or technical positions in a variety of fields—not just positions in his special field of study or training.

The Civil Service Commission will not, however, open an examination to the general public and accept applications until there are job vacancies or expected job vacancies. When vacancies exist or are expected, the Commission issues an examination "announcement" which tells about experience or training requirements, location of jobs, duties, pay, forms that must be filed, and when and where examinations will be held.

After the examination is announced, applications are accepted as long as the examination is open. Even after an examination is closed, some persons are permitted to file applications. Thus, persons who cannot file their applications before the examination closing date because they are in military service or because they are working overseas for a Government agency or for an international organization such as the United

Nations, may file not later than 120 days after honorable discharge or after return from abroad. Other persons who may file their applications after an examination closing date are those that have been granted "10-point veteran preference" by the Civil Service Commission, including disabled veterans or their wives, the widows of veterans, and the widowed or divorced mothers of veterans who lost their lives while in the Armed Forces or who became totally disabled while on active duty.

A person who has been granted veteran preference by the Civil Service Commission receives extra points which are added to his passing grade in an examination. An honorably discharged war veteran gets 5 extra points. A person who is eligible for disabled veteran preference gets 10 points added to his passing score.

After examinations are rated by the Commission, applicants are notified whether they have achieved eligible or ineligible ratings. The Civil Service Commission enters the names of eligible applicants on a list in the order of their scores. When a Federal agency requests names of applicants for a job vacancy, the Commission sends the agency the three names at the top of the appropriate list. The appointing officer in the requesting agency can select any of the top three available applicants. Names of those not selected by this agency are restored to the list for consideration in connection with other job openings.

Appointments to civil service jobs are made without regard to an applicant's race or religion. Civil service employees can vote as they choose, but they are prohibited from rendering certain political services and may not be forced to contribute to any political fund.

After a person is appointed to a Federal job through a civil service competitive examination, he must complete a 3-year period of conditional service to acquire full career standing. Generally, his appointment is probationary during the first year. He can be dismissed if his work is not satisfactory within this period merely upon written notice giving the reason for the dismissal and the effective date. After he has completed the 1-year probationary period, he has the same protections against dismissal as career employees (within limitations mentioned below). A career or career-conditional employee may be promoted, reassigned to another job in his agency, transferred to another agency, or reinstated without time limit after leaving the Federal service, without competing in examinations with the general public. He can be removed from the career service only for cause—such as inefficiency, misconduct, or insubordination—after adequate review to protect him against dismissal for arbitrary or capricious reasons.

Federal employees who demonstrate outstanding ability are encouraged to prepare for more responsible assignments. Although agencies tend to promote from within, they also seek workers elsewhere in the Federal service or outside the Federal service to obtain the best qualified person for each position.

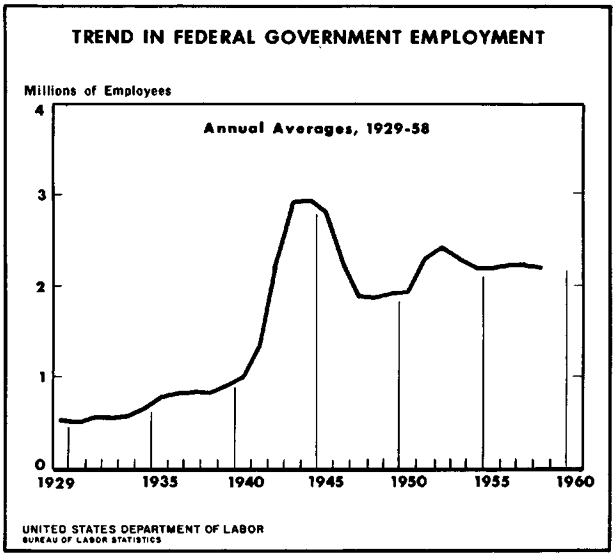
Layoffs, or "reductions in force," are sometimes necessary in the Federal Government for such reasons as cuts in appropriations made by the Congress and decreases in work in certain fields. When a reduction in force occurs, *an employee may be either retained or separated by the agency affected depending on*: Whether he has career status, whether he is a veteran or nonveteran, how many years of service he has, and how well he has performed his duties. A career employee receives retention preference over career-conditional and temporary employees, and a veteran receives retention preference over nonveterans with the same type of appointment. A Federal employee who is separated in a reduction in force is entitled to unemployment compensation similar to that provided for employees in private industry. He is covered by the unemployment insurance system in the State or area in which he worked.

Employment Trends and Outlook in Federal Government

Each year the Federal Government hires several hundred thousand employees. In recent years, the majority of these workers were employed as replacements for employees who left the Government because of retirement, resignation, illness, or death.

In the past, Federal Government employment has not shown a steady rate of increase, but rather has been sharply affected by national emergencies. For example, the number of Federal workers in the continental United States increased during the World War II period from

CHART 54



about 1,000,000 in 1940 to a high of approximately 2,900,000 in 1944. Again, during the Korean crisis, employment rose from about 1,900,000 in 1950 to 2,400,000 in 1952. Between 1953 (the end of the Korean hostilities) and 1958 the employment level has remained relatively stable, averaging about 2,200,000. (See chart 54.)

Employment in the Federal Government has increased in the long run not only because of the need for a stronger defense establishment, but also because of the more important role the United States has been playing in world affairs, and the greater activity of the Federal Government in such fields as agriculture, social security, conservation and flood control, veterans' services, and the regulation of interstate commerce. The need to service a growing population in such activities as the postal service has also contributed to an expansion in Federal Government employment.

The future outlook for Federal Government employent is difficult to predict because the number of Federal workers is determined by the needs of our domestic governmental programs and our international responsibilities, as defined by the Congress.

The most important factor determining employment opportunities in the Federal Government is the need for replacements. During 1958, for example, there were more than 450,000 accessions to the Federal work force. At the same time, about 425,000 workers left Federal employment. Of the 450,000 workers appointed in 1958, approximately 75 percent had some type of Civil Service status—either career, career-conditional, or temporary; the remainder were excepted appointments.

Earnings, Advancement, and Working Conditions

Federal civilian employees are paid under several pay systems. In June 1958, about 43 percent of all full-time employees were paid under the Classification Act; 21 percent were paid under the Postal Pay Act; 31 percent under the wage board pay system; and the remaining 5 percent were paid under other pay systems.

Pay rates for employees under the Classification Act are set by the Congress and are nationwide in coverage. In June 1958, median (average) annual salary for the Federal employees in the United States paid under the Classification Act was $4,640.

The Classification Act provides a pay scale called the General Schedule (GS) for employees in professional, administrative, technical, and clerical jobs, and for employees such as guards and messengers. The jobs under the General Schedule are classified and arranged in pay grades according to difficulty of the duties, the responsibilities, and knowledge, experience, or skill required. The distribution of Federal white-collar employees by grades in the General Schedule, together with the entrance and maximum salary as well as the amount of periodic increases for each grade, are listed in table 1.

Employees in all grades except GS–18 receive periodic "step" increases if their job performance is satisfactory. In each of the first 10 grades, the increases occur every 12 months until the maximum salary is reached. In grades GS–11 through GS–17, they occur every 18 months. Employees in grades GS–1 through GS–15 also get "longevity increases" if they continue to serve in the same grade after they have reached the maximum salary.

The number of employees in each pay grade differs, of course, from one occupation to another. These differences are illustrated in table 2 which shows the distribution of employees in three selected occupations.

TABLE 1. *Distribution of Federal employees under Classification Pay Scale by grade level, June 30, 1958*

General schedule grade	Employees		Salaries [1]		
	Number	Percent	Entrance	Periodic increases	Maximum
1	3, 995	0. 4	$2, 960	$95	$3, 530
2	53, 371	5. 8	3, 255	95	3, 825
3	179, 488	19. 5	3, 495	95	4, 065
4	155, 882	16. 9	3, 755	95	4, 325
5	104, 527	11. 3	4, 040	150	4, 940
6	40, 406	4. 4	4, 490	150	5, 390
7	82, 715	9. 0	4, 980	150	5, 880
8	23, 758	2. 6	5, 470	150	6, 370
9	90, 692	9. 8	5, 985	150	6, 885
10	13, 051	1. 4	6, 505	150	7, 405
11	69, 575	7. 6	7, 030	240	8, 230
12	49, 648	5. 4	8, 330	240	9, 530
13	32, 217	3. 5	9, 890	240	11, 090
14	14, 031	1. 5	11, 355	240	12, 555
15	6, 605	. 7	12, 770	240	13, 970
16	750	. 1	14, 190	240	15, 150
17	324	(2)	15, 375	240	16, 335
18	118	(2)	17, 500		17, 500

[1] Salary scale effective January 12, 1958, U.S. Civil Service Commission.
[2] Less than 0.05 percent.

SOURCE: U.S. Civil Service Commission, Federal Employment Statistics Bulletin, July 1958.

As shown in this tabulation, the vast majority of clerk-typists are in grades GS–2 and GS–3. The likelihood that a clerk-typist will receive a salary higher than that of grade GS–3 is remote unless he can qualify for and be promoted to a position in another occupation that has a higher salary structure. The bulk of the secretaries are in grades GS–4 and GS–5. Only about 1 percent of the secretaries advance to grades higher than grade GS–7. In sharp contrast to the grade distribution in these occupations, electronic engineers are concentrated in grades GS–9, GS–11, GS–12, GS–13, and more than 7 percent of them advance to salary levels higher than grade GS–13.

New appointments to professional entrance-level positions such as those filled through the Federal Service Entrance Examination, described earlier in this chapter, are usually made at the entrance salary in grade GS–5 with some appointments at GS–7 of especially well-qualified individuals. An eligible individual who holds a master's degree, or the equivalent in education or experience, will usually enter at grade GS–7 and those who are especially well qualified may enter at grade GS–9. Appointments to entrance-level positions requiring less than professional-level training are usually made in the grades below GS–5, the exact grade and corresponding salary depending on the difficulty and responsibilities of the position.

Although most new appointments are usually made at the entrance salary rate in the appropriate pay grade, the Civil Service Commission can authorize recruitment at rates above the usual entrance salary for hard-to-fill positions. For example, new employees were being recruited above the minimum rates in grades GS–5 and GS–7 for engineering and certain physical science jobs in 1958.

Employees are not promoted to a higher grade automatically. Promotions depend upon openings in higher grades and upon the ability and work performance of the individual employee. Sometimes, however, it is not necessary for an employee to move to a new job to get a promotion. If his work assignments become more difficult and his responsibilities increase, his job

TABLE 2. *Grade distribution of full-time Federal Government employees in three selected occupations, February 28, 1957*

General schedule grade	Clerk-typist		Secretary		Electronic engineer	
	Number	Percent	Number	Percent	Number	Percent
Total	86, 396	100. 00	26, 274	100. 00	610	100. 00
1	690	0. 80				
2	21, 431	24. 81	2	0. 01		
3	63, 302	73. 27	671	2. 55		
4	42	. 05	9, 759	37. 14		
5	24	. 03	10, 995	41. 85	40	0. 71
6	2	(1)	3, 074	11. 70	1	. 02
7			885	3. 37	208	3. 71
8			168	. 64	2	. 04
9			135	. 51	832	14. 83
10			13	. 05	8	. 14
11			13	. 05	1, 573	28. 04
12			2	. 01	1, 680	29. 95
13					863	15. 38
14					291	5. 19
15					100	1. 78
16					12	. 21
Not specified [2]	905	1. 05	557	2. 12		

[1] Less than 0.01 percent.
[2] Includes positions not reported by General Schedule grades.

SOURCE: Occupations of Federal White-Collar Workers, February 28, 1957, Pamphlet 56-1, June 1958. U.S. Civil Service Commission.

may be reclassified to a higher grade with a corresponding increase in pay.

For the 459,000 postal service workers in the continental United States paid under the Postal Field Service Compensation Act, the median (average) annual salary was $4,875 in 1958. Workers usually start as substitute clerk or carrier and move up to regular jobs when there is a vacancy. Entrance pay was $2 an hour for substitute clerks in first- and second-class post offices and substitute carriers in the city delivery service.

About 600,000 skilled tradesmen and manual workers employed by the Federal Government in the United States in 1958 were paid under the wage board system. The pay rates for these blue-collar workers are fixed by wage boards on the basis of "prevailing" rates paid for similar work by private employers in the areas where they work, rather than by legislation. The median annual pay of employees paid under this system was $4,888 in 1958. The following tabulation shows pay rates in effect in April 1959 for selected blue-collar occupations in specific labor market areas:

City	Common laborer	Electrician	Machinist, general
Atlanta, Ga	$1. 61	$2. 17	$2. 23
Boston, Mass	1. 97	2. 41	2. 45
Charleston, S.C	1. 48	2. 17	2. 25
Chicago, Ill	2. 11	2. 85	2. 96
Denver, Colo	1. 98	2. 58	2. 67
Fort Worth–Dallas, Tex	1. 78	2. 23	2. 29
Hampton Roads, Va	1. 66	2. 25	2. 32
Houston–Galveston, Tex	1. 80	2. 27	2. 33
Los Angeles, Calif	2. 13	2. 78	2. 88
New Orleans, La	1. 79	2. 62	2. 74
New York, N.Y.–Newark, N.J	2. 08	2. 74	2. 83
Pensocola, Fla	1. 63	2. 29	2. 37
Philadelphia, Pa	2. 03	2. 42	2. 47
Portsmouth, N.H	1. 70	2. 28	2. 33
Puget Sound, Wash	1. 98	2. 41	2. 46
San Diego, Calif	1. 94	2. 40	2. 46
San Francisco, Calif	2. 19	2. 55	2. 60
St. Louis, Mo	2. 01	2. 49	2. 54
Washington, D.C	1. 88	2. 62	2. 72

SOURCE: Army-Air Force Wage Board, U.S. Department of Defense. Rates are for the second rate of a four rate pay range.

About 57,000 Federal Government employees in the United States in 1958 were paid under acts or orders other than those discussed above. The median annual salary of these employees was $5,280. Among the employees paid under the miscellaneous pay acts or orders were those working for the Tennessee Valley Authority, the Foreign Service of the Department of State, and physicians, dentists, and nurses in the Bureau of Medicine and Surgery of the Veterans Administration.

The standard workweek for Federal Government employees is 40 hours and the pay schedules are based on this workweek. If an employee is required to work more than 40 hours a week, he is either paid overtime rates for the additional time worked or he is given compensatory time off at a later date. Most employees usually work 8 hours a day, 5 days a week, Monday through Friday. However, the head of an agency may decide on a different schedule for his agency. Annual earnings, for most full-time Federal workers, are relatively little affected by seasonal factors.

Federal employees receive paid vacations and sick leave. They earn 13 days of annual (vacation) leave during each of their first 3 years of service, then 20 days each year until they have completed 15 years of service; and after that, 26 days of leave each year. In addition, they earn 13 days of paid sick leave a year. Eight paid holidays are also observed annually. Employees who are members of military reserve organizations are also granted up to 15 days of paid military leave a year for training purposes. Court leave with pay is granted to employees to attend court as a Government witness or for jury duty.

Other benefits available to most Federal employees include: A contributory retirement system providing retirement annuities based on salary, length of service, and either age or disability, along with survivorship annuities; optional participation in a low-cost group life insurance program supported in part by the Government; and compensation to employees injured in performance of duty.

Where To Go for More Information

Information on Federal employment opportunities is available from a number of sources. For college students, the college placement office is often a good source of such information. High school students in many localities may obtain information from their high school vocational guidance counselors. Additional information about Federal job opportunities and Civil Service competitive examinations may be obtained from the central and regional offices of the Civil Service Commission, State employment service offices, and post offices in many cities. The central office and regional offices of the U.S. Civil Service Commission are listed below along with the States included in each region.

Central Office—U.S. Civil Service Commission, Washington 25, D.C.

First Region—Post Office and Courthouse Building, Boston 9, Mass. (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.)

Second Region—Federal Building, Christopher St. at Washington, New York 14, N.Y. (New York and New Jersey.)

Third Region—U.S. Customhouse, Second and Chestnut Sts., Philadelphia 6, Pa. (Pennsylvania, Delaware, Maryland, and Virginia.)

Fifth Region—Peachtree-Baker Building, 275 Peachtree St. NE., Atlanta 3, Ga. (North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Puerto Rico, and the Virgin Islands.)

Sixth Region—Post Office and Courthouse Building, Cincinnati 2, Ohio. (Ohio, Indiana, Kentucky, and West Virginia.)

Seventh Region—New Post Office Building, Chicago 7, Ill. (Michigan, Wisconsin, and Illinois.)

Eighth Region—1114 Commerce St., Dallas 2, Tex. (Arkansas, Oklahoma, Louisiana, and Texas.)

Ninth Region—New Federal Building, 12th and Market Sts., St. Louis 1, Mo. (Missouri, Kansas, Iowa, Nebraska, Minnesota, North Dakota, and South Dakota.)

Tenth Region—Building 41, Denver Federal Center, Denver, Colo. (Colorado, New Mexico, Utah, Wyoming, and Arizona.)

Eleventh Region—302 Federal Office Building, First Ave. and Madison St., Seattle 4, Wash. (Montana, Oregon, Idaho, Washington, and Alaska.)

Twelfth Region—128 Appraisers Building, 630 Sansome St., San Francisco 11, Calif. (California, Nevada, and Hawaii.)

OTHER OFFICES:

Hawaii—Manager, Branch Regional Office, Twelfth U.S. Civil Service Region, Federal Building, Honolulu 2, Hawaii.

Puerto Rico (*subsidiary to Fifth Region*)—Civil Service Representative, Central Board of Examiners for Puerto Rico and the Virgin Islands, Room 218, Post Office Building, San Juan, P.R.

Canal Zone—Secretary, Board of U.S. Civil Service Examiners, Balboa Heights, C.Z.

Alaska—Manager, Branch Regional Office, Eleventh U.S. Civil Service Region, Room 203, Loussac-Sogn Building, Anchorage, Alaska.

Information on career and competitive examination opportunities in Federal agencies which have separate career system such as the Foreign Service, the Federal Bureau of Investigation, and the Atomic Energy Commission, may be obtained by writing to their respective personnel offices in Washington, D.C.

State and Local Government

State and local governments provide an important source of job opportunities in communities throughout the country. Also, since governmental activities are so varied, work opportunities are available in many different occupational fields.

In 1958, about 5.9 million (full- and part-time) workers were employed in State and local government agencies. About 75 percent of these workers, more than 4.4 million in 1958, were with units of local governments, such as counties, municipalities, towns, school districts, or special districts. The remaining 1.5 million workers were employed in State government agencies.

More State and local government employees are engaged in educational activities than any other single field; more than 2.5 million (full- and part-time) workers, or about 45 percent of all State and local government employees, were in this field. Table 3 shows the number of employees as of October 1958 in each State and the District of Columbia and the percent of total employment in education.

About 55 percent of all State and local government employees in West Virginia and South Dakota were engaged in educational activities, whereas only 27 percent of the District of Columbia employees were in educational work. The wide variation in educational employment results from many factors which include differences in the age distribution of the population in the various States, the average size of school classes, and the proportion of students enrolled in public schools in comparison with those enrolled in parochial or private schools.

In addition to teachers (see section on Teaching Occupations elsewhere in this Handbook), school systems employ administrative personnel, librarians, guidance counselors, dietitians, clerks, and maintenance workers. About 85 percent of employment in the field of education is in elementary and secondary schools, largely administered by local governments. State employment in education is chiefly concentrated in institutions of higher learning.

The next two largest areas of employment in 1958 were in hospital and highway work. They accounted for 9.3 percent and 8.9 percent of employment, respectively. The 550,000 persons employed in hospital work included physicians, nurses, medical laboratory technicians, hospital attendants, and workers in nearly all the other occupations listed in the chapter in the Handbook on Health Service Occupations. About 525,000 workers in many different occupations were employed in highway activities. State and local government workers were employed to construct and maintain regular roads, highways, city streets, toll turnpikes, bridges, and tunnels. Among these employees were civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, cement finishers, carpenters, and construction laborers.

Protective services such as the police and fire departments were other large areas of employment in State and local governments. Approximately 315,000 people were engaged in police work in 1958. Local governments account for more than 90 percent of total employment in police activity. Employment in police work is not limited to uniformed police forces, but includes also clerical, administrative, and custo-

TABLE 3. *State and local governments full-time equivalent employment*[1] *October 1958*

State	Employment, all functions[2]	Percent engaged in education
United States, total	5, 171, 000	44
Alabama	88, 000	48
Arizona	37, 000	52
Arkansas	47, 000	51
California	513, 000	43
Colorado	56, 000	49
Connecticut	69, 000	41
Delaware	13, 000	48
District of Columbia	23, 000	27
Florida	142, 000	42
Georgia	108, 000	47
Idaho	22, 000	44
Illinois	265, 000	43
Indiana	125, 000	47
Iowa	83, 000	53
Kansas	75, 000	50
Kentucky	71, 000	51
Louisiana	105, 000	45
Maine	27, 000	44
Maryland	82, 000	44
Massachusetts	161, 000	31
Michigan	241, 000	45
Minnesota	104, 000	48
Mississippi	59, 000	50
Missouri	108, 000	44
Montana	23, 000	48
Nebraska	49, 000	45
Nevada	10, 000	37
New Hampshire	17, 000	39
New Jersey	162, 000	43
New Mexico	27, 000	52
New York	588, 000	31
North Carolina	113, 000	52
North Dakota	20, 000	53
Ohio	255, 000	46
Oklahoma	71, 000	51
Oregon	60, 000	47
Pennsylvania	269, 000	43
Rhode Island	23, 000	37
South Carolina	61, 000	52
South Dakota	22, 000	55
Tennessee	98, 000	45
Texas	267, 000	50
Utah	27, 000	52
Vermont	12, 000	46
Virginia	104, 000	49
Washington	95, 000	45
West Virginia	49, 000	55
Wisconsin	108, 000	45
Wyoming	14, 000	48

[1] Part-time employees have been converted to full-time equivalents to make the data comparable between the States.

[2] Because of rounding, sum of items may not equal totals.

SOURCE: State Distribution of Public Employment in 1958, U.S. Department of Commerce, Bureau of the Census.

dial personnel. At the State level, highway police work represented the major source of employment. All of the approximately 205,000 firemen were employed by units of local government (about 70,000 of these were part-time employees).

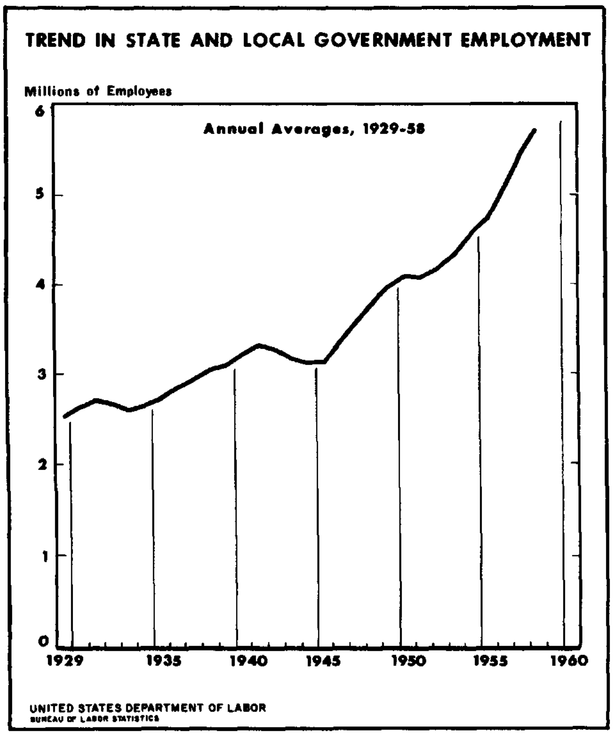
Another large group of workers, more than 470,000 full- and part-time workers, in 1958, were employed in general control activities—most of them at the local level. General control functions include the activities of chief executives and their staffs and legislative bodies; the administration of justice; tax enforcement; and other financial activities and general administrative work. Lawyers, judges and court officials, tax agents, accountants, and recording clerks are examples of persons found in this field of governmental activity.

Other State and local government employees are engaged in a wide variety of other fields—social security administration, public welfare, prison operation, management of liquor stores, and the operation of local utilities including water, electric, transit, and gas supply systems. These functions require workers in many different types of occupations; for example, welfare workers, social workers, prison guards, electrical engineers, electricians, pipefitters, and bus drivers.

Clerical, administrative, maintenance, and custodial workers constitute a significant proportion of all employees in many areas of government activity. Among the more important groups of workers engaged in these occupations are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors.

State and local government employment opportunities are distributed among the states roughly in proportion to their population. For example, the large States (New York, California, Pennsylvania, Illinois, Texas, and Ohio) which have approximately 40 percent of the Nation's population, also employ about 40 percent of the State and local government work force.

CHART 55



Employment Trends and Outlook

The long-range trend of employment in State and local governments has been upward. (See chart 55.) In 1958, about 5,900,000 (full- and part-time) employees were working for State and local governments—almost three times the number in 1920. In the post-World War II period, employment increased from 3,600,000 in 1946 to 5,900,000 in 1958, a gain of about 64 percent.

State and local government employment has expanded primarily because of the rapid population growth, expansion of the school systems, and urbanization. Urban development has required more highway facilities, health and sanitation services, fire and police protection, and other services. A continued steady increase in State and local government employment seems likely in the 1960–70 decade. In particular, a substantial growth in educational employment is anticipated as a result of the rising school-age population. In addition to employment opportunities arising from the expected overall growth in State and local government employment, thousands of employees will be needed to replace those workers who retire, die, or transfer to other fields of work. Retirements and deaths alone will

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probably result in the need for more than 100,000 new workers annually during the 1960–70 decade.

Most positions in State and local governments will be filled by persons who are permanent residents of the particular State and locality where they seek employment. Often, however, it is necessary for State and local governments to recruit outside their areas whenever they want specialized personnel, or if shortages of particular skills exist in their areas.

Earnings and Working Conditions

Earnings of State and local government employees depend first of all, of course, on the employee's occupation. Information on salary rates paid for any specific occupation can be obtained from the appropriate agencies in each State or locality.

As can be seen in the following tabulation, the average monthly earnings in October 1958 of State and local government employees varied considerably:

United States	$365	Montana	$354
Alabama	270	Nebraska	299
Arizona	414	Nevada	390
Arkansas	260	New Hampshire	327
California	456	New Jersey	407
Colorado	354	New Mexico	350
Connecticut	411	New York	404
Delaware	366	North Carolina	314
District of Columbia	459	North Dakota	335
Florida	326	Ohio	367
Georgia	256	Oklahoma	307
Idaho	316	Oregon	377
Illinois	412	Pennsylvania	356
Indiana	358	Rhode Island	334
Iowa	330	South Carolina	261
Kansas	310	South Dakota	305
Kentucky	294	Tennessee	279
Louisiana	309	Texas	320
Maine	292	Utah	344
Maryland	379	Vermont	311
Massachusetts	359	Virginia	312
Michigan	422	Washington	400
Minnesota	381	West Virginia	313
Mississippi	247	Wisconsin	393
Missouri	323	Wyoming	330

SOURCE: State Distribution of Public Employment in 1958, U.S. Department of Commerce, Bureau of the Census.

Average earnings, from state to state, are affected by such factors as the level of economic development and the degree of urbanization. As can be seen from the above tabulation, monthly earnings of full-time State and local government employees ranged from $247 in Mississippi to $459 in the District of Columbia.

The average earnings of State and local government employees vary considerably even among those performing similar functions. Average monthly earnings in October 1958, for employees engaged in various functions ranged as follows:

Function [1]	*Average monthly earnings of full-time employees*
All functions	$365
Education	399
Public schoools	395
Instructional personnel	447
Other	263
State institutions of higher education	436
Other	362
Functions other than education	338
Highways	327
Public welfare	314
Hospitals	265
Health	356
Sanitation	327
Police protection	387
Local fire protection	412
Natural resources	346
Water supply	343
Other local utilities	435
General control	353
All other	347

[1] Because a considerable number of educational employees are paid on a 9- or 10-month school term basis, average earnings for this group for a single month, such as October, cannot be used directly to estimate comparative annual earnings of educational personnel as against other employees. The lower average earnings for hospitals reflect only cash compensation and do not include the value of meals, lodgings, or other payments-in-kind.

SOURCE: State Distribution of Public Employment in 1958, U.S. Department of Commerce, Bureau of the Census.

A majority of State and local government positions are filled by some type of formal civil service test, and personnel are hired and promoted on the basis of merit. In some areas, broad groups of employees, such as teachers, firemen, and policemen have separate civil service coverage which applies only to their specific groups.

More than half of all the employees of State and local governments come under the coverage of State-administered retirement systems; most of the remainder are under either locally administered systems or under the Federal Old-Age and Survivors Insurance program. Nearly all teachers and full-time local policemen and firemen are covered by some kind of retirement provisions.

Most State and local government employees work a 40-hour week; overtime pay or compensatory time benefits are often granted for hours of work in excess of the standard workweek.

Where To Go for More Information

People interested in working for State or local government agencies should inquire about salary rates, job openings, how to apply for employment, and other information at the appropriate agencies in each State, county, or city. Local school boards, city or municipal clerks, school and college counselors or placement offices, and local offices of State employment services will also have or can tell applicants where to get information.

Armed Forces

Young men planning their careers must take into account their military service obligation. By knowing the choices open to them for the fulfillment of this obligation, they can better integrate military service with preparation for life careers and, in many cases, receive valuable vocational training while in the service. The Armed Forces also offer many opportunities to qualified young men and women for lifetime careers in many occupational fields.

At the present time, our Armed Forces are maintained through voluntary enlistment supplemented by a Selective Service System which drafts young men between the ages of 18½ and 26 in the number necessary to bring the total Armed Forces up to the desired level. A young man has the choice of enlisting in any one of a variety of programs involving different combinations of active service and reserve duty; or he may wait to be drafted for a 2-year period of active duty, followed by 4 years in the reserves.

These enlistment choices and the draft are subject to change at any time by Congressional action. The alternative choices described here in a general way serve only to illustrate a few possibilities. Detailed up-to-date information can be obtained from local Armed Forces Recruiting Stations or from such publications as It's Your Choice, and Your Life Plans and the Armed Forces. The former is available by writing to the following address:

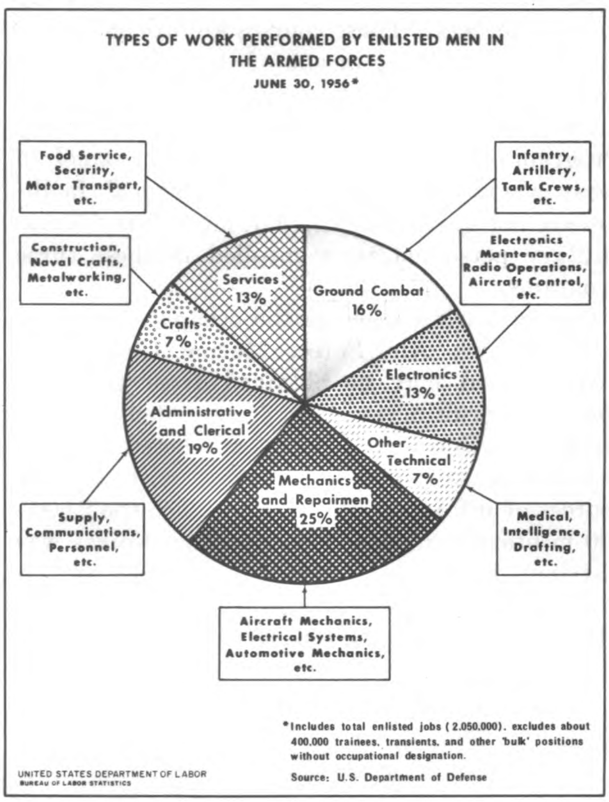
It's Your Choice
Washington 25, D.C.

Your Life Plans and the Armed Forces is available at all high schools and colleges in the country.

The Reserve Forces Act of 1955 provided additional choices for fulfilling military obligations. One of these important new choices allows a young man to fulfill his military obligation by enlisting in the reserves for 8 years, 6 months of which is spent in active duty training. This enables him to complete his active military service in a 6-month period just after high school, before he enters college or starts to work.

If a young man wants to go directly to college he can remain in a deferred status by qualifying for student deferment or, upon entering college, by enrolling in ROTC or certain other

CHART 56



officer training programs. A young man who wants to enter an industry training program directly from high school may qualify for apprentice deferment and complete apprentice training before entering military service.

About half of all enlisted jobs in the Armed Forces requires training in a skilled trade or a technical specialty, it is possible for a young man, during his military service, to receive training in electronics, aircraft maintenance, metalworking, or other skilled work. (See chart 56.) Such work can often be utilized later in civilian employment. To receive this kind of training, it is usually necessary to enlist for more than 2 years.

In addition to specific on-the-job experience, the Armed Forces provide enlistees with a wide choice of voluntary off duty educational programs. Military personnel may enroll in (1) the U.S. Armed Forces Institute, (2) the Resident Center Program, or (3) the Group Study Program. The U.S. Armed Forces Institute offers more than 200 correspondence courses ranging from the elementary level to the first 2 years of college. The Resident Center Program provides for college-level classroom courses leading toward degrees. These courses are offered either at military posts or in one of the many colleges and universities which participate in this program in the United States. The Group Study Program is designed for military personnel in areas where regular civilian educational facilities are not available. In 1957, more than 600,000 military personnel were enrolled in these three programs.

General information on the occupations in the Army, Navy, Air Force, Marine Corps, and Coast Guard may be obtained from their respective recruiting stations. Career fields in the Navy, Air Force, and Army are listed in later sections of this chapter together with further sources of information. In early 1959, the 2,600,000 military personnel in the Armed Forces was distributed between the various services as follows: Army, 889,000; Air Force, 852,000; Navy, 634,000; Marine Corps, 186,000; and Coast Guard, 31,000.

Army

The Army has divided its occupations into 62 occupational career fields classified into 10 occupational areas, which are explained in the United States Army Handbook, Army Occupations And You, Office of the Adjutant General, Department of the Army, Washington 25, D.C., revised edition 1956. Briefs on the career fields describe job organization, duties and responsibilities, work environment, qualifications, training given, advancement, and related civilian jobs. Each brief contains a job progression chart showing normal lines of advancement and indicating areas of work involved in the particular career field. The handbook contains additional sections on requirements for enlistment, pay scale and allowances, educational opportunities in the Army, opportunities for commissioned and warrant officers, opportunities for women in the Army, aptitude areas, and an index to related civilian jobs. The handbook is available in all high schools and Army recruiting stations. Information on every job in each career field is given in greater detail in the Manual of Enlisted Military Occupational Specialties, AR 611–201, March 1955. Although intended for military use, this book is useful to civilians as well, because of its thorough examination of each job specialty. The manual is available at all Army recruiting stations, posts, and installations. The Army's 10 occupational areas and the 62 occupational specialties are as follows:

1. Combat
   - Infantry
   - Combat engineering
   - Armor
   - Field artillery
   - Anti-aircraft artillery
2. Electronics
   - Electronic countermeasures operation
   - General electronic equipment repair
   - Artillery fire control operations and maintenance
   - Guided missile operations and maintenance
   - Electronic fire control equipment repair
   - Guided missile electronic guidance systems repair
   - Atomic weapons
   - Fixed station radio repair
   - Radar and television repair
   - Radio and carrier repair

3. Electrical maintenance
   - Field communications
   - Telephone outside plant maintenance
   - Telephone inside plant maintenance
   - Teletypewriter equipment maintenance
   - Electrical equipment maintenance
4. Precision maintenance
   - Precision maintenance, general
   - Ammunition
   - Armament maintenance
   - Atomic weapons and guided missile mechanical assembly and repair
   - Metalworking
   - Prosthetic appliances
   - Quartermaster equipment maintenance
5. Military crafts
   - Construction
   - Utilities
   - Chemical
   - Marine operations and maintenance
6. Motor maintenance
   - Construction equipment operation
   - Engineer equipment maintenance
   - Automotive maintenance
   - Motor transport
   - Railway maintenance
   - Railway operations
   - Aircraft maintenance
7. Clerical
   - Administration
   - Communications center operations
   - Finance
   - Information
   - Machine accounting
   - Supply
8. Graphics
   - Drafting and cartography
   - Surveying
   - Printing
   - Pictorial
9. General technical
   - Air traffic controller
   - Chemical and petroleum laboratory
   - Meteorological observer
   - Medical care and treatment
   - Physical medicine
   - Medical laboratory
   - Food service
   - Military police
   - Military Intelligence
10. Special assignment
    - Scientific and professional
    - Bondsman
    - Radio code
    - Recruiting and special services
    - Animal care

Air Force

The Air Force has published a manual for vocational guidance counselors and Air Force personnel officers called the Occupational Handbook of the United States Air Force, Headquarters, U.S. Air Force, The Pentagon, Washington 25, D.C., 1958. This handbook contains briefs on each of the 42 airmen career fields. Each brief includes a statement of the scope of the particular career field and an organizational chart which shows the relationship between the various jobs and indicates the paths of advancement. For the various jobs in a career field, the brief gives a description of duties and responsibilities, qualifications and preparation, training given, and related civilian jobs. The handbook also has special sections on pay rates, opportunities for a commission, women in the Air Force, and reserve components. In addition, there is a valuable school subject index to airmen career fields. This publication is available in all high schools, State employment service offices, Air Force recruiting stations, and Air Force bases. The following are the airmen career fields:

Intelligence
Photomapping
Photographic
Weather
Air traffic control and warning
Communications operations
Radio and radar systems
Guided missile systems
Armament systems maintenance and gunner
Atomic weapons
Training devices
Wire maintenance
Intricate equipment maintenance
Aircraft accessories maintenance
Aircraft and engine maintenance
Production control
Munitions and weapons maintenance
Motorized and miscellaneous equipment maintenance
Metalworking
Construction
Utilities
Firefighting
Fabric, leather, and rubber
Marine
Transportation
Food service
Supply
Procurement
Accounting, finance, and auditing
Statistical, analysis, data processing and data programming
Administrative
Printing
Information
Personnel
Special services
Education and training
Band
Air police
Special investigations
Medical
Aircrew protection
Dental

Navy

The occupational structure of the Navy is explained in the United States Navy Occupational Handbook, Bureau of Naval Personnel, Washington 25, D.C., 1956. This handbook contains 62 vocational information briefs on Navy occupations classified into 12 major groups. Each brief explains the purpose of the job, duties and responsibilities, work assignments, qualifications, and preparation, training given, paths of advancement, and related naval or civilian jobs. Promotions, pay rates, retirement provisions, and other aspects of careers in the Navy are explained in the introduction. Included in the handbook are additional sections on women in the Navy, commissioned officers, the Naval Reserve, and the Submarine Service. This publication is available in all high schools, colleges, public libraries, State employment service offices, and Navy recruiting stations. The Navy occupational fields are as follows:

Boatswain's mate
Quartermaster
Sonarman
Radarman
Torpedoman's mate
Gunner's mate
Fire controlman
Fire control technician
Mineman
Electronics technician
Instrumentman
Opticalman
Teleman
Radioman
Communications technician
Yeoman
Personnel man
Machine accountant
Storekeeper
Disbursing clerk
Commissaryman
Ship's serviceman
Journalist
Lithographer
Nuclear seaman
Musician
Draftsman
Photographer's mate
Machinist's mate
Machinery repairman
Boilerman
Engineman
Electrician's mate
Interior communications electrician
Metalsmith
Pipefitter
Damage controlman
Patternmaker
Molder
Surveyor
Construction electrician's mate
Driver
Mechanic
Builder
Steelworker
Utilities man
Aviation machinist's mate
Aviation electronics technician
Aviation electronicsman
Aviation ordnanceman
Air controlman
Aviation boatswain's mate
Aviation electrician's mate
Aviation structural mechanic
Parachute rigger
Aerographer's mate
Aviation photographer's mate
Tradevman (training devices man)
Aviation storekeeper
Hospital corpsman
Dental technician
Steward

Technical Appendix

This Appendix is designed for the use of readers who wish more information on the sources and procedures followed in developing the conclusions on employment outlook than is presented in the nontechnical discussions in the individual occupational reports. The occupational classification followed in the Dictionary of Occupational Titles and shown by the D.O.T. numbers given in the occupational reports is also explained.

Employment Outlook Conclusions

The sections on employment outlook in the occupational reports present conclusions based not only on information compiled from many sources but also on extensive economic and statistical analysis. Although the sources used and the methods of analysis differed among occupations because of differences in the factors influencing the demand for workers and the available supply, the same general pattern of research was followed in all of the outlook studies.

The starting point in most studies was an analysis of past and prospective population trends, including the changes expected in population of school and college age, in numbers of older people, in employment of women, and in the concentration of population in and around cities. In fields such as teaching, the health professions, and many personal services, population factors have a direct and obvious influence on employment opportunities. They are also of great importance in many industries—for example, residential construction, telephone communications, men's clothing, and retail trade.

Many factors besides population may affect the volume of business and employment in a given industry. Consumer purchasing patterns change with shifts in preference from one type of product to another, and with the development of new products which cut into the market for old ones. A general rise in income levels can create new markets for more expensive items. Technological developments not only bring changes in the raw materials and equipment used in production, but they also influence the size of the required work force and the kinds of occupations and skills needed.

In studying the outlook in each industry, the factors having the greatest influence in that industry were analyzed and projections were made of demand for the industry's products or services. These projections were then translated into estimates of the numbers and kinds of workers required to produce the indicated amounts of products or services—in view of the relative numbers currently employed in different occupations, productivity trends, probable further reductions in the workweek, and other factors. Past trends in employment were also given much weight in arriving at the conclusions as to probable future employment trends.

To assist in carrying through this analysis and ensure that the assumptions made in the different occupational studies were consistent, overall projections of the economy over the next two decades were developed. This general analytical framework included projections of the population, labor force, gross national product, average hours of work, employment in major industries, and related economic measures, by 5-year intervals up to 1975. In all studies of separate occupations and industries, the employment projections were tied in with those derived from the projections of the entire economy.

The basic data on population and labor force trends used for the overall employment projections and for the studies of individual occupations and industries, are from the decennial Censuses of Population and the monthly Current Population Surveys conducted by the Bureau of the Census. The analysis and interpretation of these data stemmed from the Bureau of Labor Statistics continuing program of labor force studies.

Equally indispensable to the studies of employment trends in major industries were the statistics on employment in nonagricultural establishments compiled by the Bureau of Labor Statistics. These estimates prepared on a monthly basis, provide data on employment, hours of work, earnings, and labor turnover based on reports from about 155,000 establishments. They are available for a great number of different industries, for the past quarter-century or more.

Another Bureau program which contributed to the analysis of future employment trends was its studies of productivity and technological developments. Anticipated productivity trends and technological changes were allowed for in converting the projections of demand for the products of a given industry into estimates of the numbers of workers who will be needed in that industry.

Information on the magnitude of industrial research programs and on the employment of scientists and engineers in research and other activities, from surveys conducted by the Bureau in cooperation with the National Science Foundation and other agencies, has been extensively utilized in studying the scientific and engineering professions. The findings with regard to the scale and trend of industrial research activities have contributed also to the analysis of employment prospects in many science-based industries.

Still another Bureau project which played a major role in the development of estimates of future employment requirements in different occupations is the Occupational Industry Matrix. The matrix consists of a set of tables for 159 industry sectors which represent the entire economy of the United States. For each industry sector, the tables show a percentage distribution of employment among about 150 of the most important occupations and also among the major occupational groups.

The matrix was valuable in appraising the effects of changing employment levels in different industries on employment in specified occupations. It was also useful in estimating the numbers of workers currently employed in each occupation. This was an important function, since for many occupations the 1950 Census of Population was the most recent source of basic data on employment, and for many others only fragmentary data were available which had to be integrated by means of the matrix in order to derive overall estimates of employment.

Conclusions based on the analysis of information from these many sources generally indicate increases in employment and, hence, openings for new workers. However, expected gains in employment are by no means an adequate indication of the total numbers of job openings which will need to be filled. In most occupations, more workers are needed yearly to fill positions left vacant by those who leave the occupation (to enter other occupations or because of retirement or death) than are needed to staff new positions created by growth of the field. Rarely do occupations grow fast enough so that the reverse is true. Even occupations which are declining in size may offer employment opportunities to many young people.

In estimating the number of openings likely to arise in an occupation, use has been made of Bureau of Labor Statistics studies of occupational mobility among selected groups of workers, and of Tables on Working Life, also developed by the Bureau. The tables, which are similar to the actuarial life tables used by insurance companies, provide a basis for assessing replacement rates owing to deaths and retirements which may result from differences in the age and sex of the workers in various occupations. In many occupations, for example, men comprise the great majority of workers and the death and retirement rate is generally between 1 and 4 percent. The rate is usually somewhat higher in women's occupations, however, because so many women leave paid employment to get married and assume family responsibilities; thus, the replacement rate among stenographers, typists, and secretaries is at least 6 percent a year.

The types of information mentioned so far in this section all relate to the demand for workers. In order to appraise the prospective employment opportunities in an occupation, it is important to have information also on the probable future supply of personnel. The statistics on high school and college enrollments and graduations compiled by the U.S. Office of Education are the chief source of information on the potential supply of personnel in the professions and other occupations requiring extensive formal education. Data on numbers of apprentices from the Bureau of Apprenticeship and Training provide some information on new entrants into skilled trades.

Many of the statistical sources and analytical approaches referred to above have been developed only within comparatively recent years. The reader should bear in mind that economic forecasting is still in an early stage of development and that it is, at best, difficult and uncertain. It is necessary to keep in mind also the basic assumptions underlying the forecasts—continuance of generally high levels of economic activity and the absence of large-scale war. The Bureau believes that, within this general framework of assumption, the basic trends affecting employment can be discerned with sufficient accuracy to meet the needs of young people preparing for careers.

D.O.T. Classification Numbers

The reports in this Handbook have been grouped in the manner which seemed most appropriate in view of the needs of the users and the realities of the industrial world. The arrangement followed does not conform to any one established system of classifying occupations. Provision has been made, nevertheless, to meet the needs of those persons who wish to relate the occupations discussed to an established classification system. To indicate where each occupation fits into the classification system of the Dictionary of Occupational Titles, D.O.T. numbers are given wherever possible following the title of the occupation. The first digit of each of these numbers indicates the major occupational group in which a given occupation is classified, and the second digit the subgroup, as follows:

0 Professional and managerial occupations:

0–0 through 0–3	Professional occupations
0–4 through 0–6	Semiprofessional occupations
0–7 through 0–9	Managerial and official occupations

1 Clerical and sales occupations:

1–0 through 1–4	Clerical and kindred occupations
1–5 through 1–9	Sales and kindred occupations

2 Service occupations:

2–0	Domestic service occupations
2–2 through 2–5	Personal service occupations
2–6	Protective service occupations
2–8 and 2–9	Building service workers and porters

3 Agricultural, fishery, forestry, and kindred occupations:

3–0 through 3–4	Agricultural, horticultural, and kindred occupations
3–8	Fishery occupations
3–9	Forestry (except logging), and hunting and trapping occupations

4, 5 Skilled occupations.

6, 7 Semiskilled occupations.

8, 9 Unskilled occupations.

Index I. Occupations Classified by Broad Fields of Work

This index is designed to help counselors and young people locate information on occupations related to particular fields of interest or aptitude —for example, artistic or technical work, mechanical repair work, farming, or selling. It classifies the occupations discussed in this Handbook according to a classification system developed by the U.S. Employment Service as an aid in counseling and placing inexperienced applicants—"the Entry Occupational Classification" published as Part IV of the Dictionary of Occupational Titles.

Persons wishing to locate information about occupations which fall within a given general field of work—professional work, for example—can locate under the main heading "Professional, technical, and managerial work," references to the information presented on each profession covered in the Handbook. Those interested in more specific fields such as work related to electrical engineering can locate, under this subheading, references to the statements on engineers and on various related occupations such as broadcast and electronic technicians and air transport ground radio operators. In general, the page references in this index relate only to the parts of the Handbook containing the principal discussions of the occupations in question. Index II, which provides a complete alphabetical listing of all discussions of each occupation, may be consulted for additional references.

Professional, technical, and managerial work

Artistic work

Page

Commercial artists 184
Designers, men's tailored clothing industry 613
Interior designers and decorators 194
Makeup artists, television 656
Scenic designers, television 656

Literary work

Newspaper reporters 203

Entertainment work

Announcers, radio and television 660
Musical directors, radio and television 655
Program directors, radio and television 655

Public service work

INSTRUCTIVE SERVICE WORK

Agricultural extension service workers 725
Film librarians, television 656
Home economists 190
Librarians 200
Medical record librarians 92
Occupational therapists 95
Teachers, college and university 47
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