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# OCCUPATIONAL OUTLOOK HANDBOOK



UNITED STATES DEPARTMENT OF LABOR

BUREAU OF LABOR STATISTICS

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## Pointers on Using the Handbook

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

**To locate an occupation or industry in this book, see:**

Table of Contents, page xi.  
Alphabetical Index, page 735.

**For a general view of work and jobs** in the United States, read the chapter on Tomorrow's Jobs, page 13.

**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, as well as the methodology presented in the Technical Appendix, page 733.

**The job picture is constantly changing.** To find out how you can keep your information up to date, see the chapter on Where To Go For More Information or Assistance, page 7.

**You may need local information too.** The *Handbook* 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 10.

# OCCUPATIONAL OUTLOOK HANDBOOK

*EMPLOYMENT INFORMATION ON OCCUPATIONS  
FOR USE IN GUIDANCE*

**BULLETIN NO. 1550**  
Revision of Bulletin 1450



**UNITED STATES DEPARTMENT OF LABOR**

**Willard Wirtz, Secretary**

**BUREAU OF LABOR STATISTICS**

**Arthur M. Ross, Commissioner**

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1968-69 Edition

A Revised Edition of the Handbook Is Published Every 2 Years

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## Foreword

The major manpower challenge of this decade is to insure that our citizens receive the training and education they need to perform useful and rewarding work in our changing economy; that our education and training are geared to the needs of the individual as well as the needs of society.

The Department of Labor's *Occupational Outlook Handbook*, with its broad coverage of occupations and industries, seeks to define the various facets of the 20th Century world of work. In doing so, it serves as a basic tool for helping prospective workers to make intelligent decisions about the occupational course they will follow.

WILLARD WIRTZ, *Secretary of Labor*

## Prefatory Note

Recent legislation in the fields of manpower and education has heightened the demand for counseling services. Because only a limited number of counselors are available to meet this demand, occupational information has become more vital than ever as a tool in the guidance process.

The 1968–69 edition of the *Occupational Outlook Handbook* continues the progress that has characterized the Bureau's occupational outlook program for more than a quarter of a century. It includes more statements on occupations for which people having relatively low levels of skill and education may qualify. In addition, an introductory statement for each major industry group highlights occupational trends in the industry. The introduction, "Tomorrow's Jobs," has been completely revised to provide young people with a brief overview of the world of work and the economic and other factors that affect the choice of a career. The new *Handbook* includes many changes recommended by counselors and other readers; its format has been changed to make the volume easier to read.

This *Handbook*—eighth in a series which began in 1949—provides counselors and others with the latest information about the employment outlook, earnings, training requirements, and related information for over 700 occupations. It also assesses the impact of future economic, social, and educational trends on the employment outlook in industries and occupations. The *Handbook* is used extensively in various Federal programs concerned with vocational counseling, such as those of the Veterans Administration, the Department of Defense, and the U.S. Employment Service, as well as in the State employment services.

The Bureau of Labor Statistics also issues the *Occupational Outlook Quarterly*, a periodical which keeps readers informed of the latest developments between editions of the *Handbook*, and the *Occupational Outlook Reprint Series*, a set of over 100 reprints of the *Handbook* statements on different fields of work. Both of these publications offer assistance to young people seeking career information.

Hundreds of officials in industry, labor organizations, trade organizations, professional societies, government agencies, educational institutions, and other organizations have cooperated with the Bureau of Labor Statistics in preparing the *Handbook*. Their assistance is acknowledged with gratitude.

ARTHUR M. ROSS, *Commissioner of Labor Statistics*

## Letter From the American Personnel and Guidance Association

Each year the growth and development of the Nation's economy bring many changes in employment outlook important to our youth. New occupations emerge. Old ones change in content and attractiveness. The outlook in both the old and the new may be affected markedly by such factors as the level of defense expenditures, automation and technological development, the birth rate, consumer expenditures, and other influencing factors.

To keep abreast of the results of these changes, counselors and young persons need an authoritative, current source of information. The *Occupational Outlook Handbook* continues to provide, in its biennial edition, just the kind of sophisticated economic analysis counselors need. Each one should make sure they have the latest edition on hand.

Guidance and counseling personnel are fortunate that the wide-ranging research activity of the Bureau of Labor Statistics has been put to such good use in compiling this compact, readable guidance encyclopedia and its companion periodical, the *Occupational Outlook Quarterly*. Another new edition continues our good fortune as we seek to aid each individual to find that type of work suited to his interest and aptitude.

E. G. WILLIAMSON, *President*  
*American Personnel and Guidance Association*

## Letter From the Veterans Administration

The beneficiaries served by the Veterans Administration cover a broad spectrum, from the teenage war orphan who needs to plan his post-high school education to the severely disabled veteran requiring vocational rehabilitation. In the wide array of counseling and rehabilitation problems presented by this diverse group, one factor is common. All need to make their educational and vocational plans in the context of current, sound information about the rapidly changing occupational structure of the world of work they will enter. The *Occupational Outlook Handbook*, revised biennially, is a major source of such information.

The *Handbook*, in its present form, is an outgrowth of a project originated to meet the needs for occupational information in the Veterans Administration counseling and training program for World War II veterans. Greatly expanded in aims, scope, and coverage, it has for many years provided a useful tool for counselors and those being counseled. The Veterans Administration looks forward to the *Handbook's* continued usefulness and welcomes the publication of the 1968-69 edition.

W. J. DRIVER  
*Administrator of Veterans Affairs*

## Letter From the Bureau of Employment Security

In 1966, more than 10.5 million individuals came to the public employment service for jobs. Many thousands of them also needed information *about* jobs—job content, job qualifications, earning potential, possibilities of advancement, and outlook for employment.

This need is especially true of youth seeking work for the first time, of adults wishing to change vocations, and for senior citizens who have been displaced from their jobs.

Counseling such individuals is a keystone in the work of the public employment service. Annually, over a million individuals benefit from job counseling. During these interviews, the *Occupational Outlook Handbook* is used to supplement the knowledge of the counselor and to satisfy more fully the jobseeker's desire for information.

The Bureau of Employment Security welcomes this new edition of the *Occupational Outlook Handbook*. Its improved, comprehensive format and expanded content will contribute immeasurably to the effectiveness of job counseling in the 2,000 local offices and 170 Youth Opportunity Centers which make up the employment service network.

ROBERT C. GOODWIN, *Administrator*  
*Bureau of Employment Security*  
*U.S. Department of Labor*

## Letter From the Vocational Rehabilitation Administration

The 154,000 handicapped people who were rehabilitated in our Federal-State program in 1966 went into almost every kind of employment there is. A number of blind people were trained as computer programmers and got the jobs in that highly specialized work. Men and women with all kinds of physical and mental handicaps went to work as teachers, auditors, nurses, dentists, draftsmen, policemen, elevator operators, homemakers—the list is long.

This year, there will be an even greater variety of jobs open to our program's clients, as larger numbers of them are rehabilitated and as more and more employers learn that disabled people, like anybody else, have many abilities as workers.

I know that your handbook of occupations is being used often by the vocational rehabilitation counselors who are seeking and finding jobs for their clients all across the country. I know this new edition of valuable career information will be used even more frequently in our expanded effort to place disabled people in the most appropriate employment that can be found.

MARY E. SWITZER, *Commissioner of Vocational Rehabilitation*  
*U.S. Department of Health, Education, and Welfare*



## Letter From the United States Office of Education

America has set a goal that is simple to state but intensely difficult to carry out: Each member of our society, we say, should have the opportunity to develop his talent and interests to the maximum for his own good and for the good of the country.

Each year millions of young men and women begin earnest pursuit of this objective. They stand on the threshold of the job market, each qualified by ability and ambition, each intent on satisfaction and fulfillment in a career.

Their choice is not a simple one: There are thousands of different ways in which a person can earn a living. In a massive pairing exercise, talent must be matched with opportunity, desire with need, individual with job.

To the vocational counselor seeking to bring about the best solutions, there is one indispensable reference, the *Occupational Outlook Handbook*, through its previous seven editions the basic work on occupational information.

Compiling the eighth edition of this invaluable guide, the Bureau of Labor Statistics has managed to improve upon its excellent predecessors and produce an even finer compilation of job information. To the Bureau—and particularly to the *Handbook* staff—I would like to extend the congratulations and the thanks of the Office of Education.

HAROLD HOWE II, *U.S. Commissioner of Education*  
*U.S. Department of Health, Education, and Welfare*

## Letter From the Department of Defense

Armed Forces counselors have been using the *Occupational Outlook Handbook* for many years. It is a primary source of occupational information used in guiding members of the Armed Forces with respect to their off-duty educational programs or in preparation for their return to civilian life.

Servicemen have many opportunities to participate in off-duty educational programs throughout their military service; they are encouraged to pursue educational goals that will help their military careers and prepare them for future civilian careers. The *Occupational Outlook Handbook* has been tremendously useful to Armed Forces counselors in providing career information for both professional and citizen soldiers.

On the basis of our experience with this valuable career guide, we commend it to all concerned with career planning.

LYNN M. BARTLETT, *Deputy Assistant Secretary of Defense for Education*

## Contributors

The *Handbook* was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook, under the supervision of Howard V. Stambler and Sol Swerdloff. General direction was provided by Harold Goldstein, Assistant Commissioner for Manpower and Employment Statistics.

The general planning and coordination of the *Handbook* was done under the direction of Morton Levine. Russell B. Flanders supervised the research underlying the occupational statements.

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Analyses of the occupational composition of industries for use in the *Handbook* were prepared in the Division of Occupational Employment Statistics, Robert B. Steffes, Chief, under the supervision of Harry Greenspan.

The chapter on Agricultural Occupations was prepared in the Farm Economics Division, Economic Research Service, U.S. Department of Agriculture, under the direction of Wylie D. Goodsell.

## Photograph Credits

The Bureau of Labor Statistics gratefully acknowledges the cooperation and assistance of the many government and private sources that either contributed photographs or made their facilities available to U.S. Department of Labor photographers for this edition of the *Occupational Outlook Handbook*.

### Government Sources

*Federal.* Atomic Energy Commission; Department of Agriculture—Forest Service; Department of Commerce—Environmental Science Services Administration, and National Bureau of Standards; Department of Health, Education, and Welfare—National Institutes of Health, and Vocational Rehabilitation Administration; Department of the Interior—Bonneville Power Administration, and Bureau of Land Management; Department of Justice—Federal Bureau of Investigation; Department of Labor—Bureau of Employment Security; Department of the Navy—Naval Gun Factory, Naval Observatory, and Naval Research Laboratory; Department of Transportation—Federal Aviation Administration; Federal Power Commission; General Services Administration—National Archives and Records Service; Government Printing Office; National Aeronautics and Space Administration; Office of Economic Opportunity; Post Office Department; and Smithsonian Institution.

*State and Local.* Arlington County (Va.) Public Schools; Commonwealth of Virginia, State Police Department; District of Columbia Police Department; and Grant County (Wash.) Public Utilities District.

### Private Sources

*Individuals.* Harold C. Conklin, Ph. D.; George De Vincent, Arena Stage; and Jerome Footer, D.D.S.

*Membership Groups.* Amalgamated Clothing Workers of America; American Association of Medical Record Librarians; American Bar Association; American Chiropractic Association; American Dental Association; American Dietetic Association; American Federation of Teachers; American Forest Products Industries, Inc.; American Geological Institute; American Occupational Therapy Association, Inc.; American Optometric Association; American Paper and Pulp Association; American Podiatry Association; American Psychological Association; American Society of Planning Officials; American Speech and Hearing Association; American Trucking

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*Industry and Business.* Air Reduction Co., Inc.; American Airlines, Inc.; American Telephone and Telegraph Co.; Armstrong Cork Co.; Atchinson, Topeka and Santa Fe Railway Co.; Atlantic Research Corp.; Babcock and Wilcox Co.; Banning and Sons Motors, Inc.; Bob Peck Chevrolet; Burroughs Corp.; Carrier Corp.; Chesapeake and Potomac Telephone Co.; Chrysler Corp.; Cincinnati Milling Machine Co.; Cities Service Oil Co.; Cleaverbrook Co.; Cluett, Peabody and Co., Inc.; Collins Radio Co.; Columbia Records; Container Corporation of America; E. I. Du Pont de Nemours and Co.; El Paso Natural Gas Co.; Esso Research and Engineering Co.; Fairchild Camera and Instrument Corp.; First National City Bank of New York; Ford Motor Co.; General Dynamics/Electronics; General Electric Co.; General

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*Publications.* Electric Appliance Service News; Implement and Tractor; Industrial Photography; National Jewelers; Shoe Service; Signs of the Times; Traffic World; The Washington Post; and The Washington Star.

*Schools.* Culinary Institute of America; George Washington University; International Institute of Interior Design, Inc.; Joseph Bulova School of Watchmaking; and Washington School of the Ballet, Inc.

*Others.* Argonne National Laboratory; Johns Hopkins University Applied Physics Laboratory; Oak Ridge National Laboratory; and Washington Hospital Center.

### Note

A great many trade associations, professional societies, unions, and industrial organizations are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of *Handbook* users, the statements on separate occupations or industries list some of the organizations or other sources which may be able to provide further information. Although 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 U.S. 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.

*The occupational statements in this Handbook are not intended, and should not be used, as standards for the determination of wages, hours, jurisdictional matters, appropriate bargaining units, or formal job evaluation systems.* These descriptive statements are presented in a general, composite form and, therefore, cannot be expected to apply exactly to specific jobs in a particular industry, establishment, or locality.

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# OCCUPATIONAL OUTLOOK HANDBOOK

## USING THE HANDBOOK IN GUIDANCE SERVICES

“Let each become what he is capable of becoming.” To become vocationally mature one must have information about the world of work. The more information and knowledge an individual possesses, the better his plans will be to achieve his role in the world of work, and the world of leisure.

In recent years, knowledge has been multiplying at an ever increasing rate. Consequently, most occupations which are affected by new knowledge—and what job is not?—will be subject to change. As work patterns change with the times, worker functions also will shift.

The *Occupational Outlook Handbook*, now in its eighth edition, has become an invaluable tool in counseling and placement programs. Over the years, as both the *Handbook* and guidance services have matured, they have become mutually dependent on each other. Surveys of counselors and

other users of the *Handbook* indicate that it is the best single source of occupational information and is the publication most frequently used.

The *Handbook*, like other source materials, is intended to provide the individual with information about occupations and to assist him with his career decisions. It is a bound volume of occupational briefs providing pertinent information concerning occupations in which over 75 percent of all workers in the United States are engaged. Descriptions include the nature of the job, location of employment, training and other qualifications required, employment outlook, earnings and working conditions, and where additional information may be obtained.

The *Handbook* service includes:

—Reprints of individual occupations which permit filing by occupation in each counselor's office as well as in the library.

—Supplementary charts illustrating occupational trends and guidance principles and concepts.

The *Handbook* is current. It is revised every 2 years and permits the counselor and counselee to keep abreast of the rapid changes in the occupational structure. This is important since most authorities agree that all occupational materials more than 5 years old should be discarded.

The *Handbook* is used in a variety of counseling and educational settings: Junior and senior high schools, vocational and technical schools, junior and community colleges, counselor preparation programs, college student personnel centers, private and public placement and counseling agencies, and youth opportunity centers.

Its primary contribution is in the field of career counseling and educational planning. Properly used, the *Handbook* can broaden the coun-

seele's background of occupational information by revealing the important factors influencing occupations; this will help him to develop desirable and satisfying plans for the future. By carefully studying the *Handbook*, counselors, parents, and pupils can learn the many ways in which occupations are changing, growing, and declining, and the necessity for flexible planning in the choice of a major interest area.

Helping individuals to achieve vocational maturity is a very complicated process. Many persons play important roles in such development, but key roles should be played by trained personnel in the helping professions: Counselors, teachers, guidance workers. The *Handbook* is a basic source for these people.

One publication cannot appeal equally to all grade levels, reading levels, and levels of vocational maturity. However, the Bureau of Labor Statistics has overcome many of the limitations common to the printed word by liberal use of graphics and pictures, and by simplifying the language as much as possible. In school, students can receive group instruction in the use of the *Handbook*. They need to know what the *Handbook* can and cannot do for them. They need to know where the *Handbook* can be found. They need to know

that it supplements other sources of information, such as that derived from observational and exploratory work, experience, education, and discussions with employers and recent graduates who are engaged in occupations in which students are interested.

Since many occupations which will be important a decade hence have not yet evolved, a student having some years of preparation before him may be encouraged to elect a broad curriculum and perhaps identify a general area of interest, such as science, social studies, or art. Specialization may be delayed until a later date. The further he goes in school, the better opportunity he will have to select his major field of interests. The more familiar he is with areas of work as described in the *Handbook*, the better prepared he will be to plan his own future as his education progresses.

Counselors can use the *Handbook* and related materials not only with students but also with parents in helping them counsel their children. The reprints are especially valuable because they may be borrowed easily for home reading.

The local guidance worker should supplement the *Handbook's* national occupational data with local community occupational and educational information.

Use of the *Handbook* in individual and group counseling is important in helping the individual to perceive himself in the world of work. However, the *Handbook* should not be considered a substitute for individual exploration of vocational interests. The individual has the privilege of making his own decisions. He also has the privilege to seek and to obtain reliable information.

Schools and other local agencies will have to decide how much to budget for the occupational file. There are approximately 300 private and public sources of information. An agency can spend several hundred dollars a year purchasing materials reviewed by the career guidance service of the National Vocational Guidance Association and references contained in bibliographies prepared by the Bureau of Labor Statistics and several private publishers. Materials should be ranked on a priority basis depending upon the budget and other factors. Most agencies have found that the *Occupational Outlook Handbook* service, including the Reprint Series, has a very high priority.

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# GUIDE TO THE HANDBOOK

This book answers many questions young people ask when they are interested in choosing an occupation. It provides many types of information on occupations—the employment outlook in each field, 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

The *Handbook* starts with three introductory chapters designed to help counselors and students make effective use of the book and to give them a general view of the world of work.

This chapter, the Guide to the Handbook, 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 kept in mind in interpreting the statements. 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 introductory chapter also contains a brief description of the counseling, placement, and other services available to jobseekers at local offices of State employment services affiliated with the U.S. Employment Service. The final introductory chapter describes some of the most important trends in population and employment, both current and prospective, and provides a background for interpreting the reports on particular occupations.

## Occupational Reports

The reports on different fields of work make up the main body of the book. The seven major divisions of the book are: Professional and related occupations; managerial occupations; clerical and related occupations, sales occupations, service occupations, skilled and other manual occupations, and some major industries and their occupations. Within each of these major divisions, occupations are grouped into related fields. The introductory statement for each major industry group provides occupational trends in the industry.

## Indexes and Appendix

To help the readers locate information on the occupations in which they are interested, a detailed list of the occupational reports, by field of

work, is included in the table of contents at the front of the book. The index at the back of the book lists occupations and industries alphabetically.

The technical appendix 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 this chapter. The appendix

also contains an explanation of the D.O.T. numbers given in the occupational reports, to indicate where each occupation fits into the classification system of the *Dictionary of Occupational Titles*.

*D.O.T. Numbers:* The occupations covered in the *Occupational Outlook Handbook* are organized according to the occupational classification system developed by the Bureau of Employment Security

of the U.S. Department of Labor and published in the *Dictionary of Occupational Titles*. This *Dictionary* provides a code number (the so-called D.O.T. number) for each occupation included in it. The code numbers of the D.O.T. are listed in parentheses immediately below the main occupational group headings in the *Handbook*. Volumes I and II of the D.O.T. contain job definitions; the supplement lists individual physical demands, working conditions, and training time data for each job defined in the *Dictionary*.

## SOME IMPORTANT FACTS ABOUT THE OCCUPATIONAL REPORTS

### Occupations Covered

The more than 700 occupations discussed in this *Handbook* generally are 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. Altogether, the occupations covered account for about 90 percent of all workers in professional and related and in sales occupations; nearly as high a proportion in skilled occupations; about half in clerical and about 40 percent in service occupations; and smaller proportions in semi-skilled occupations. The main types of farming occupations also are discussed.

General information on many fields of work not covered in the occupational reports is contained in the introductions to the major divisions of the book. These introductions are designed to aid the reader in interpreting the reports on individual occupations.

### Sources of Information

Information on employment trends and outlook and the many related topics discussed in the occupational reports was drawn from a great variety of sources. It is based in part on extensive field investigation carried out by the Bureau of Labor Statistics professional staff. Interviews with hundreds of persons in industry, un-

ions, trade associations, and public agencies provided a wealth of the latest information. In addition, the Bureau's other research programs supplied data on employment in different industries, productivity and technological developments, wages and working conditions, trade union agreements, industrial hazards, and a number of other topics. Additional data regarding the nature of the work in various occupations, training and licensing requirements, wages, and employment trends were provided by other agencies of the Federal Government—among them, the Bureau of Apprenticeship and Training and the Bureau of Employment Security in the Department of Labor; the Bureau of the Census of the Department of Commerce; the Office of Education and the Vocational Rehabilitation Administration of the Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Commission; the Interstate Commerce Commission; the Civil Aeronautics Board; the Federal Communications Commission; and the Department of Transportation. 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.

After the information from these many sources was brought together

and analyzed, conclusions were reached as to prospective employment trends in the occupations. In addition, estimates were made of the numbers of job openings that will be created by retirements and deaths and transfers out of the occupation. The supply of new workers likely to be available in particular fields also was analyzed, by studying statistics on high school and college enrollments and graduations, data on the number of apprentices in skilled trades, re-entries to an occupation, and transfers into an occupation.

Preliminary drafts of the occupational reports were reviewed by officials of leading companies, trade associations, trade unions, and professional societies, and by 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. (See the technical index at the back of the book for a more detailed discussion of the sources of information used in the occupational reports.)

### Points To Bear in Mind in Using the Reports

In using the information on employment prospects which this book contains, it is important to keep in mind that all conclusions about the

economic future necessarily rest on certain assumptions. Among the assumptions which underlie the statements on employment outlook in this *Handbook*, are that high employment levels will be maintained and that no cataclysmic events will occur, such as a war or a severe and prolonged economic depression. Such catastrophes would, of course, create an entirely different employment situation from that likely to develop under the assumed conditions. But young people would find it impossible to build their lifetime plans in expectation of such unpredictable catastrophes, although, on the basis of historical experience, they must be prepared to weather economic ups and downs during their working lives. The assumptions and methodology used in employment outlook analysis are discussed in detail in the technical appendix, page 733.

To avoid constant repetition, the assumptions seldom are 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 as in the economy as a whole. On the other hand, in the statements on occupations where employment tends to be either unusually stable or especially subject to ups and downs, the factors affecting

employment are delineated. Even in the latter occupations, however, long-term trends in employment are more important than short-run fluctuations when appraising the prospects of an individual in a particular occupation.

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 next chapter.

The information presented on earnings and working conditions, as on other subjects, represents the most recent available when the *Handbook* was prepared early in 1967. 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.

Reference has been made in several occupational statements to training programs established under the

Manpower Development and Training Act (MDTA), to equip unemployed and underemployed persons with skills needed in today's world of work. However, the absence of a reference to MDTA training for a particular occupation does not necessarily mean that programs are not in operation. In 1967, training programs (which last from several weeks to 2 years) covered several hundred occupations—technical and semiprofessional, skilled and semiskilled, clerical and sales, service and nonagricultural. To obtain information about MDTA training offered in your area, contact the local office of the State employment service.

Finally, it should be kept in mind that information on occupations and the employment opportunities they offer is only part of that needed in making a career decision, which means matching a person and an occupation. The other part relates, of course, to the aptitudes and interests of the potential worker himself. In assessing their own abilities and interests and in selecting the occupation for which they are best suited, people can obtain help 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 detail on the occupations discussed in the occupational reports, or information on fields of work which are not covered in this publication.

Suggestions as to sources of additional information on the occupations discussed are given in most of the occupational reports. In addition, several types of publications of the U.S. Department of Labor, including periodicals described on pages 757-759, provide further information on topics such as earnings, hours of work, and working conditions. Other sources likely to be helpful include public libraries; schools; State employment services; business establishments; and trade unions, employers' associations, and professional societies. A brief description of each follows.

### Public Libraries

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

### Schools

School libraries and guidances offices also often have extensive reading materials on occupations. In addition, school counselors and teachers usually know of any local occupational infor-

mation which has been assembled through special surveys made by schools or 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. (The services available through the public employment offices are described in the concluding section of this chapter.)

**Business Establishments**

Employers and personnel officers usually can supply information about the nature of the work performed by employees in their industry or business and the qualifications needed for various jobs, as well as other facts

about employment conditions and opportunities. The names of local firms in a particular industry can be found in the classified sections of telephone directories or can be obtained from local chambers of commerce.

**Trade Unions, Employers' Associations, and Professional Societies**

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



## OCCUPATIONAL OUTLOOK SERVICE PUBLICATIONS AND MATERIALS

The Bureau of Labor Statistics has published a *Counselor's Guide to Occupational and Other Manpower Information, An Annotated Bibliography of Selected Government Publications*. The bibliography, as the title suggests, lists the major occupational and other manpower publica-

tions of Federal and State government agencies that will be useful to counselors and others interested in trends and developments that have implications for career decisions. This bulletin, No. 1421, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, at 50 cents a copy.

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 findings 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 757.

The Bureau also has developed a new visual aid for counselors entitled *Looking Ahead To A Career*. It consists of a set of 36 color slides that show the changing occupational and industrial mix and what this implies for manpower development, education, and training. The slides and the narrative used in presenting the slides are available directly from the Bureau of Labor Statistics, for \$10 a set.

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, D.C. 20212.

## SERVICES TO JOBSEEKERS AT PUBLIC EMPLOYMENT OFFICES

Local offices of State employment services specialize in finding jobs for workers and workers for jobs. The State employment services are affiliated with the U.S. Employment Service of the Manpower Administration's Bureau of Employment Security and constitute a Federal-State partnership. Employment and related services are available without charge in every State.

At each of the over 2,000 public employment service offices across the Nation, jobseekers are aided in obtaining employment, and employers are assisted in finding qualified workers.

There are four basic services provided to workers by the public employment service: (1) Job information; (2) employment counseling; (3) referral to job training or other needed service; and (4) job placement.

*Job Information.* The personnel who staff the public employment service offices are familiar with their areas and thus know what kinds of workers are employed in local industry, what jobs are available, what the hiring requirements and the opportunities for advancement are, and the wages that are paid. The staff conduct manpower surveys to determine the area's available skills, training needs, and what the future occupational opportunities will be. Through the employ-

ment service network of offices, information is also available on job opportunities in other areas of the country.

*Employment Counseling.* Employment counseling assists young people who are starting their careers, as well as experienced workers who wish or need to change their occupation. The major purposes of employment counseling are to help people understand their actual and potential abilities, their interests, and their personal traits; to know the nature of occupations; and to make the best use of their capacities and preferences in the light of available job opportunities.

The employment counselor is a specially trained individual who has access to a large store of occupational information. Testing facilities are one resource available to him. Most local offices provide testing services to help the counselor appraise the applicant's abilities, aptitudes, and preferences. Often such tests reveal aptitudes the jobseeker did not know he had. The General Aptitude Test Battery, for instance, measures basic abilities for broad fields of work and for specific jobs.

*Referral to Training.* Many individuals seek work for which they lack some qualifications. Sometimes it is a matter of basic education or the level of skill which the job requires. One of the most important functions of the public employment service, short of actually referring a jobseeker to a job, is referral to a training opportunity where he can improve his employability and thereby qualify for a job or secure a better one.

Jobs change and so do job requirements. In today's fast-paced world, important considerations when selecting a vocation are the training required to perform the work, and how that training need can be met.

*Job Placement.* A primary objective of the public employment service is to place workers in jobs. Employers'

job openings must be filled with occupationally qualified workers, and employment suited to the worker's skills, knowledge, and abilities must be found. By performing this dual function, the public employment service eliminates the waste of "hit-or-miss" job hunting.

The method of operation is basically simple. Regular contact is maintained with local employers in order to learn about their job openings. Requests are received from employers for many different kinds of workers. As a result, registered applicants have access to a variety of job vacancies with many employers, just as the employer has access to many applicants.

If job openings are not available locally, applicants may be offered the opportunity to apply for employment elsewhere in the State, in another area, or even in a foreign country. Each State employment service prepares inventories of its hard-to-fill jobs so that other State employment services may refer local workers to out-of-area jobs for which they qualify. In addition, a national network of highly specialized professional placement offices operates within the employment service network to speed the matching of jobs and applicants in professional fields.

*Special Services for Youth.* The full range of employment services is available to youth. Specialized youth units have been established in most local offices. In addition, some 170 Youth Opportunity Centers (YOC) have been established in high population areas, as a part of the public employment service system, to assist young people, particularly school dropouts, to prepare for and obtain jobs. YOC representatives go into neighborhoods where disadvantaged youth live to recruit and motivate those who do not come on their own to the center for help. These centers, established in early 1965, provide complete employment services and cooperate closely with other community agencies serving youth.

*Special Services for Disadvantaged Adults.* Through its recently established human resources development program, the employment service seeks to improve the employability of adults who have withdrawn from the work force because of some social or cultural disadvantage. An important part of this program is "outreach" into slum areas.

*Other Special Services.* Individuals with mental or physical disabilities which constitute vocational handicaps are given special consideration by the employment service.

Veterans also receive special services. Each local office has a veterans' employment representative who is informed about veterans' rights and benefits, and seeks to develop jobs for veterans.

Middle-age and older workers are assisted in making realistic job choices and overcoming problems related to getting and holding jobs. Employers are encouraged to remove unreasonable age restrictions and to base hiring on the individual's ability to perform the work.

Similar attention is given to the employment problems of minority

group members and all others facing special difficulties in obtaining suitable employment.

*Community Manpower Service.* Job-seekers, employers, schools, civic groups, and public and private agencies concerned with manpower problems are invited to utilize the service of the public employment office in their community, and avail themselves of the job information in that office. The local office which serves you is listed in the phone book as an agency of your State government.



## TOMORROW'S JOBS

Choosing a career is one of the most important decisions a young person will ever make. This choice depends on an appraisal of his interests and abilities, as well as on a knowledge of the economic and other factors that are likely to affect his future career and employment opportunities. Among these factors are changes in the composition of the country's work force and in its businesses and industries, as well as changing occupational trends. These developments in the economy are ceaseless and ever present. They affect the kinds of work that people will do and determine the changes in education and training that are required to prepare individuals for different kinds of work.

The *Handbook* contains economic information which will provide students and their counselors, teachers, and parents with answers to such

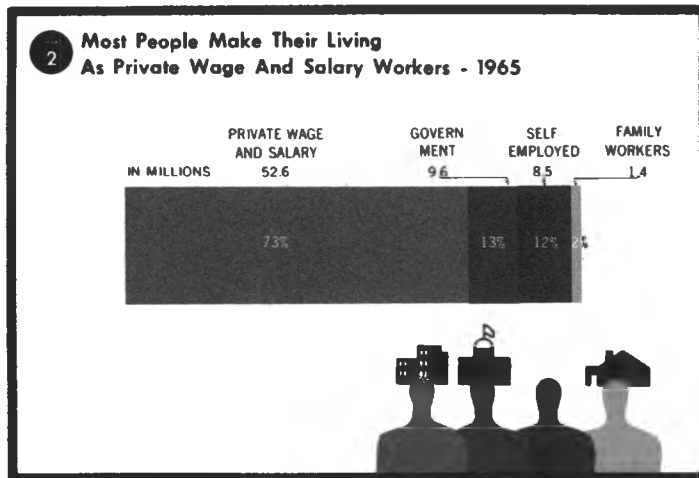
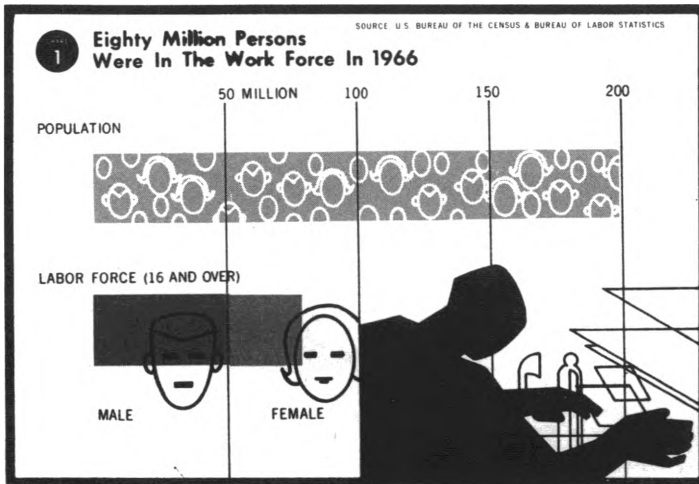
questions as: What kind of jobs will there be? What industries will provide these jobs? What qualifications will be necessary for these jobs? What fields of work look especially promising? What will the competitive situation be for young people seeking to enter the labor force?

The charts that follow will serve as a useful tool for counselors who share the major responsibility for helping young people to decide about their future educational and job plans. They graphically answer questions about the changing nature of occupations and industries and discuss the implications of these trends for career choice.

The ability of young people to maximize the opportunities that await them will depend to a great extent on their education and training. There is a need for workers to be broadly educated so that they can

more readily adapt to changing job requirements and absorb the training and retraining that may be necessary to permit them to switch jobs.

Workers who have completed the most education generally have the highest incomes. Yet, experience has shown that the amount of money one can earn over a lifetime should not be the compelling consideration in choosing a career. Job satisfaction and the many other personal rewards that flow from the right choice of a career may be even more important than monetary considerations. It follows, therefore, that a young person must first of all consider his own interests, talents, and abilities in making alternative occupational choices. (See also *Using the Handbook in Guidance Services*, p. 1 and *Services to Job-seekers at Public Employment Offices*, p. 10.)



## THE COUNTRY'S HUMAN RESOURCES SHAPE THE CHARACTER AND NATURE OF ITS MANPOWER

About 40 percent of our total population is working to provide our growing national requirements for food, clothing, shelter, and services. More than a third of these workers (27.2 million) are women.

Most people work for someone else, either for a salary or a wage. Yet 1 out of every 7 workers is either self-employed or contributing his services to a family enterprise. The majority of workers are employed in private industry, and about 13 percent work for Federal, State, and local government.

Despite the long-term shift away from employment in goods producing industries to employment in the service industries, manufacturing is still the largest employer among the major industry divisions. About 19 million persons worked in manufacturing in 1965. The second and third largest industries, trade and services accounted for nearly 14 and 13 million workers, respectively.

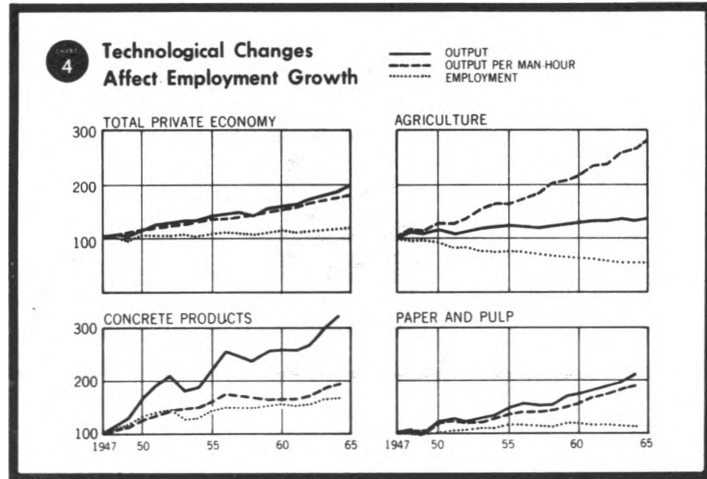
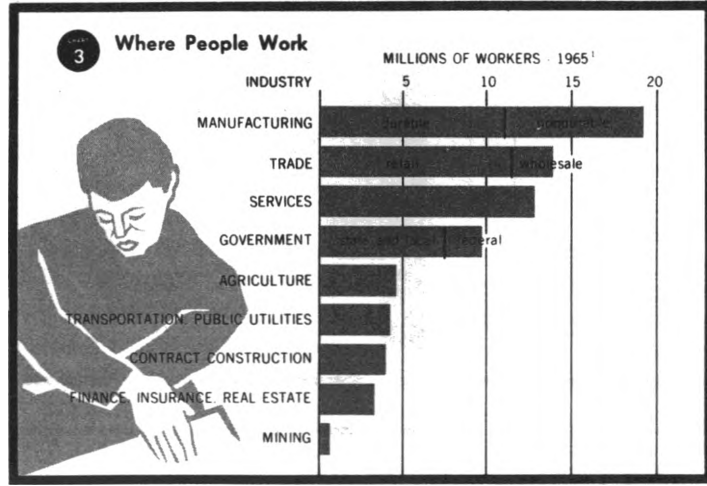
The principal occupations in these industry groups are:

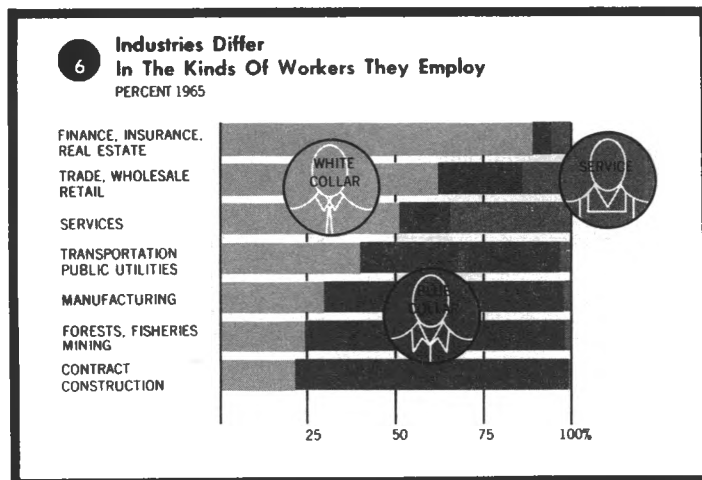
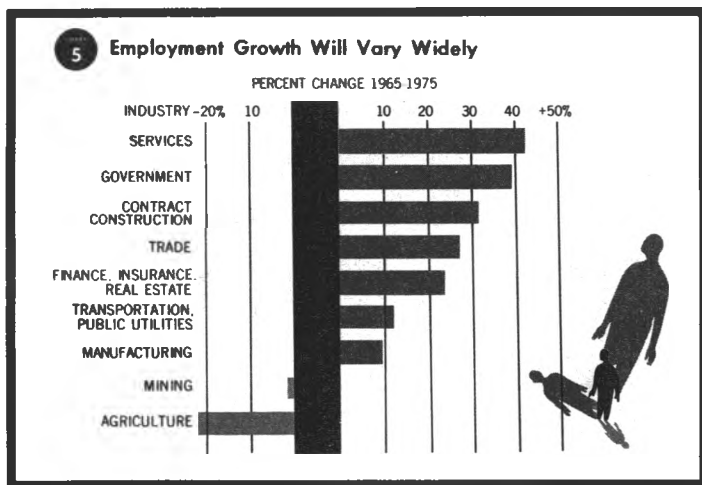
**Manufacturing:** Operatives of machines, assemblers, engineers, stenographers, production managers, tool and die makers, traveling salesmen, and unskilled laborers.

**Trade:** Sales workers, clerical workers, truckdrivers, deliverymen, elevator operators, packagers, and repair workers.

**Government:** Teachers, policemen, firemen, sanitation workers, welfare workers, clerical workers, post office workers, and public health workers.

Gains, as well as losses in employment, may result from technological innovations. Agriculture is a good example of an industry in which labor-saving technologies have been developed to such an extent that employment declines accompany increases in farm production. However, the opposite is true in the concrete products industry, where, despite rapid increases in output per man-hour, employment is rising.





Compared with a 20-percent increase in total employment over the next decade, employment in government, services, and the contract construction industries will grow much faster. Although employment in manufacturing is expected to grow only half as fast as total employment, this industry will continue to employ the greatest number of workers.

Recent developments in the fields of education, manpower, and health and welfare have intensified the demand for services of all kinds. These and other factors, such as technological innovations, have resulted in differential growth rates of industries and changes in occupational requirements.

The future employment level of individual industries is the primary determinant of occupational requirements. This is so because each industry has a unique occupational structure. For example, the structure of the insurance industry, which employs a large number of clerical, sales, and other white-collar workers, differs markedly from that of the construction industry, where employment is concentrated in blue-collar occupations—carpenters, electricians, and laborers. Consequently, a sharp change in total employment in the construction industry will have a marked effect on the requirements for blue-collar workers. Conversely, if employment in the insurance industry changes sharply, requirements for workers in white-collar occupations will be significantly affected. The second factor influencing the trend in occupational employment is the changing occupational structure within industries.



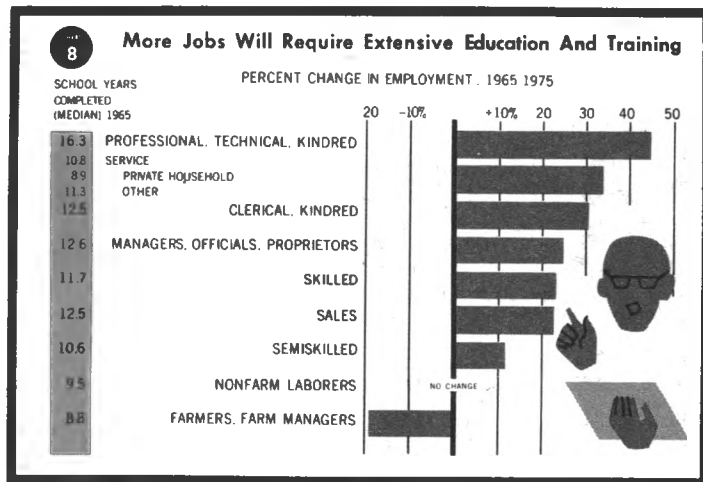
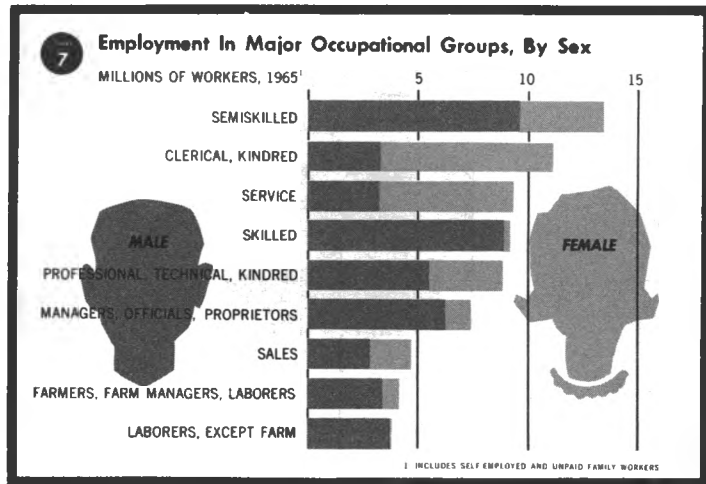
Semiskilled workers constitute the largest occupational group. In 1965, more than 13 million workers (factory assemblers, inspectors, machine operators, and apprentices; truck, taxicab, and bus drivers; and others) were employed in this occupational group, which represents an important source of work for new young male workers. The second and third largest occupational groups, clerical and service workers, are a major source of work for women. Craftsmen—the skilled worker category—make up the fourth largest occupational group; and professional workers—most of whom have had some college training—make up the next largest group.

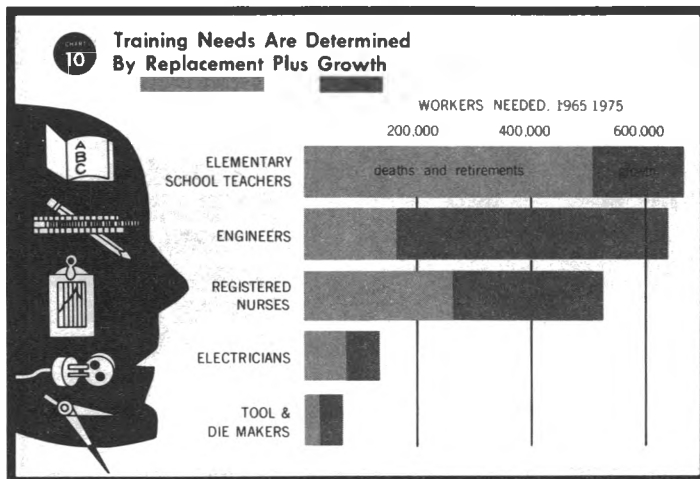
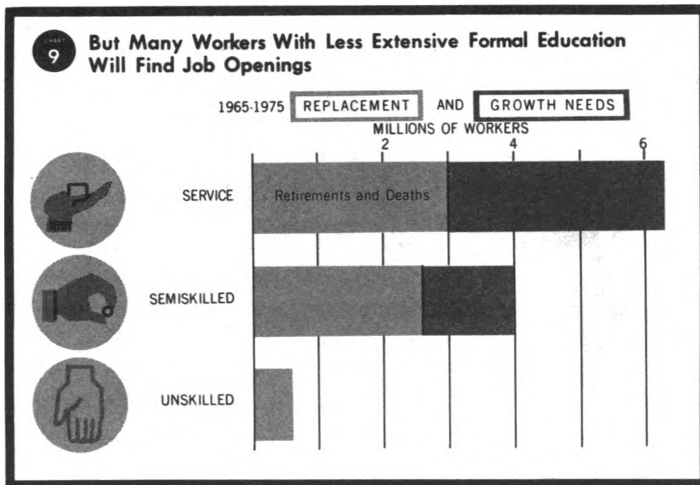
Within each occupational group, there is a diversity of jobs requiring differing levels of education and skill. For instance, among professional and related workers are nuclear physicists as well as athletes; and among service workers are FBI agents and household workers. Similarly, among sales workers, there are technical sales representatives with engineering backgrounds, as well as retail salesclerks.

In general, employment growth will be fastest among those occupations requiring the most education and training to enter.

Employment in professional and related occupations will show the fastest growth over the next 10 years—twice as fast as overall employment. These occupations generally require the most formal educational preparation to qualify for employment.

The completion of a high school education has become standard for American workers. Employers are seeking people with higher levels of education because job content is more complex and requires higher levels of skill. Many rapidly growing jobs in the clerical, sales, and service fields reflect this trend.





Even among unskilled workers, an occupational group which is not expected to increase at all during the next decade, roughly one-half million jobs will need to be filled to replace workers who die or retire.

Semiskilled workers have, on the average, about a year and a half less education than the typical American worker. Though the growth rate anticipated for this group is relatively low, 4 million semiskilled jobs are expected to be available over the next decade.

Service workers are a very diverse group and include workers with both high and low levels of education and skill. Service jobs requiring high levels of educational attainment will account for most of the projected growth of about 3 million workers. Nevertheless, due to the size of this group, another 3 million job openings will arise because of replacement needs.

### A WORD ABOUT JOB OPENINGS

Job opportunities spring from two sources: Net growth and replacement needs. In rapidly growing occupations made up mainly of young men with a long working life ahead of them, growth in the occupation will be the principal source of new jobs. On the other hand, replacement needs will be particularly high in occupations with a large proportion of older workers who have relatively few years of working life left. Similarly, job openings also arise as many women leave the labor force to take care of family responsibilities.

## A LOOK AT FUTURE MANPOWER REQUIREMENTS

### IN THE PROFESSIONS

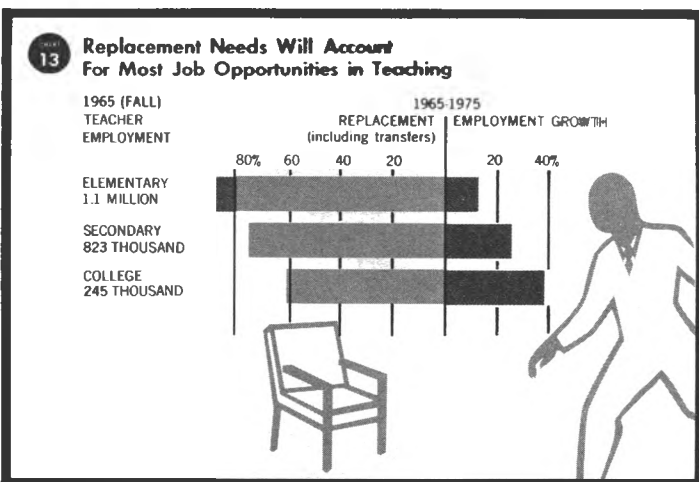
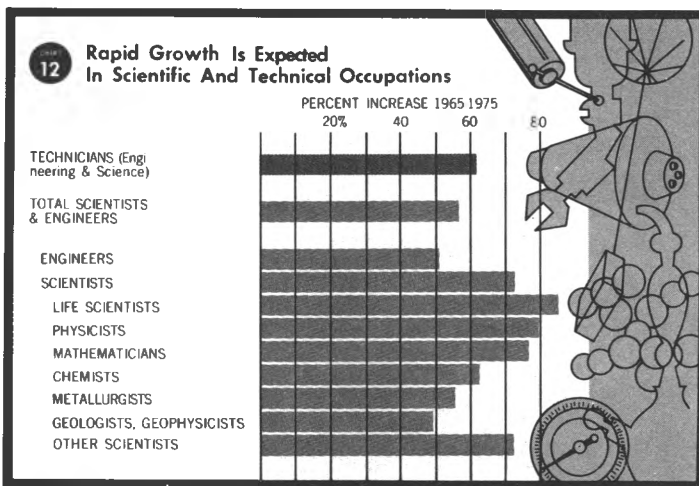
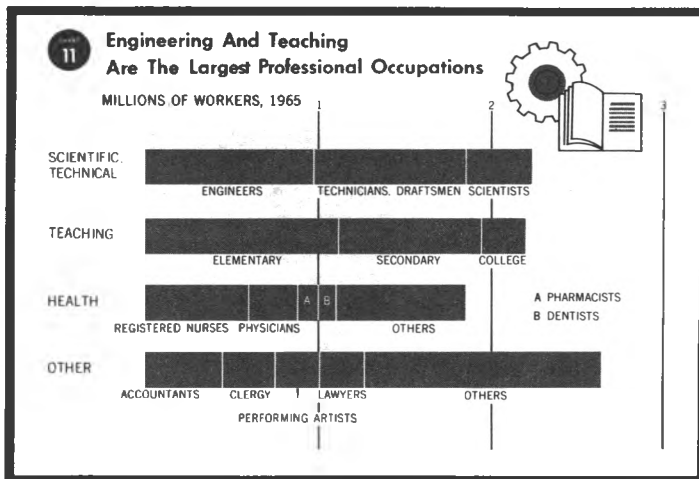
Teaching is the largest profession and, like nursing, represents a major source of employment for women. Engineering is the major field of professional employment for men.

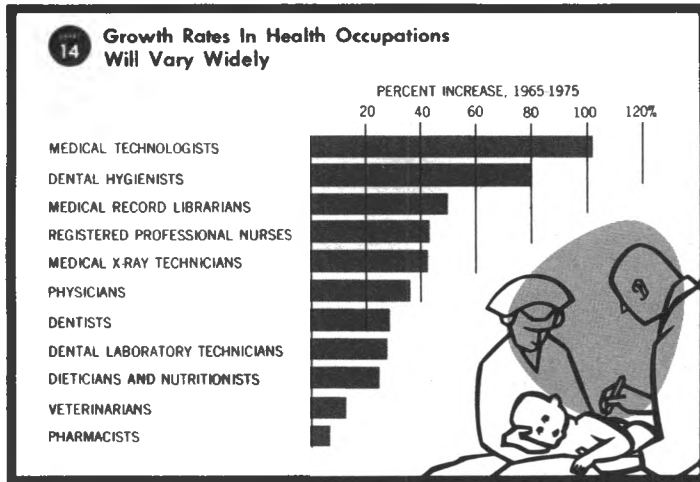
Altogether, nearly 9 million persons work in these and other professional and technical fields.

Scientific and engineering employment is expected to grow faster than that of the professional group as a whole. The growth rate for scientists is likely to be greater than that of engineers.

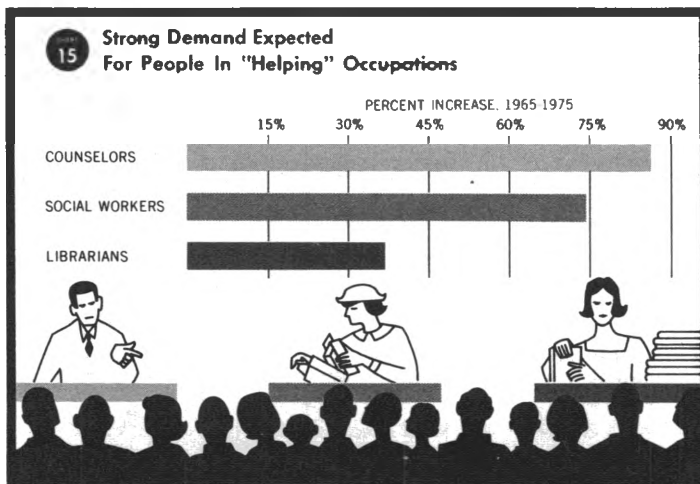
Technicians who assist engineers and scientists will also show a rapid rate of growth.

During the 1965 school year, 53 million persons—more than one-fourth of the country's population—were enrolled in schools and colleges. These enrollments are likely to exceed 60 million by 1975. To take care of this growth, the Nation's teaching staff will have to increase by about one-third (650,000); nearly three times this number (1.8 million) will be required to fill teaching positions vacated because of retirements, transfers, and deaths.





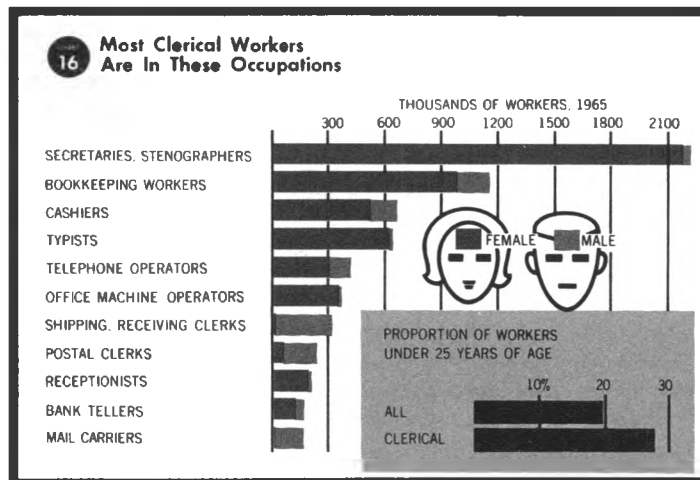
Continued rapid growth in employment is likely among paramedical workers in the health field. Persons in these occupations assist professional workers, who are in short supply, in performing the more routine aspects of their work. Educational requirements in these occupations are lower than those for entrance into the professional health occupations, and training facilities can be expanded more rapidly. Yet, in both cases, the supply of workers will have to be expanded greatly to meet health manpower requirements.



For many years, the demand for people in the "helping" professions—counselors, social workers, librarians, and others—has exceeded the available supply. The recently passed social welfare, education, and manpower legislation heightens the demand for their services. The result is that opportunities for work in these fields are virtually unlimited for qualified people.

**CLERICAL OCCUPATIONS**

Seven out of every ten persons employed in clerical occupations are women. This field is also a major source of employment for young people.



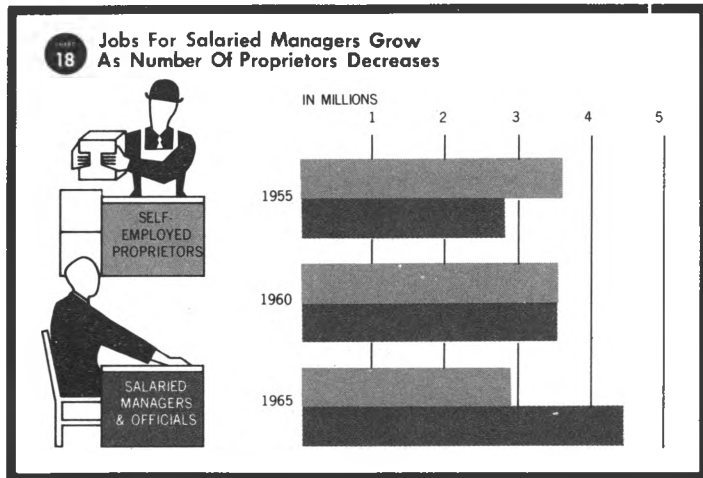
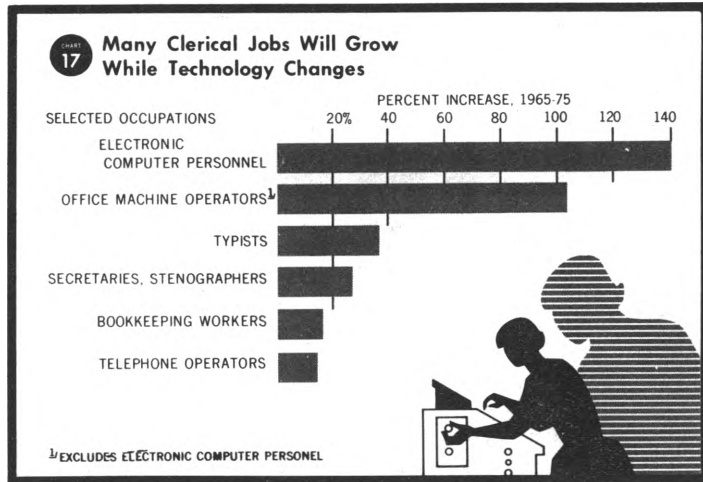
Clerical workers represent a large variety of skills. This occupational group includes, for example, highly skilled workers such as title researchers and examiners in real estate firms and confidential secretaries in businesses of all kinds. It also includes occupations such as messengers and file clerks which can be entered with little specialized training.

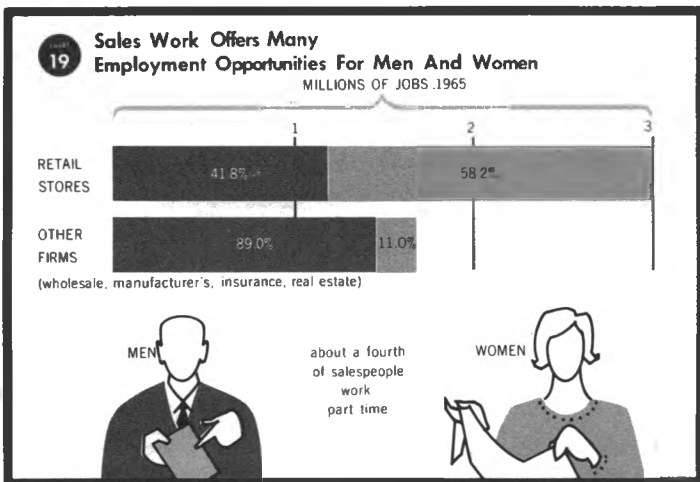
Technological innovations in this field, including the use of computers, have tended to reshape the nature of the work of office machine operators and create entirely new functions such as those performed by electronic computer personnel. Employment in these fields, though less numerous than among the traditional clerical occupations, is growing the fastest.

**MANAGERIAL OCCUPATIONS**

Employment trends among managers and proprietors have followed the longrun shift from small to large business organizations. Many independently run retail shops and firms have disappeared, and chainstores of all kinds and complex corporations have replaced them. Thus, the requirements for salaried managers and officials have far outpaced the need for self-employed proprietors, who, in fact, have been declining in number.

As a result, many thousands of job opportunities will be available for college-trained people in fields such as advertising, banking, and hotel and restaurant management, as well as in occupations such as industrial purchasing agent and industrial traffic manager.

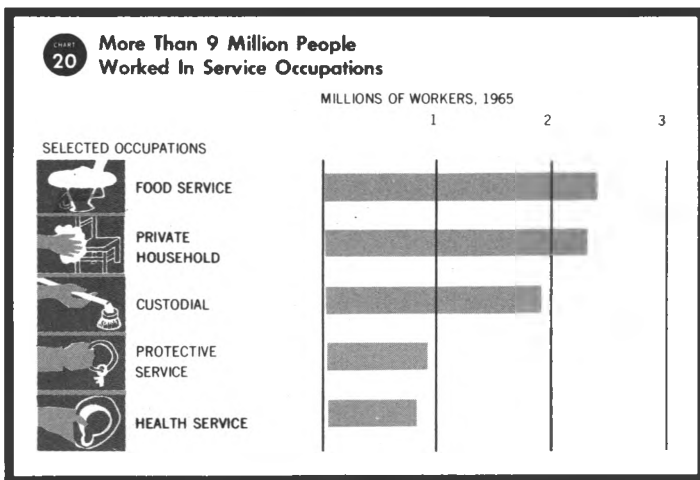




**SALES OCCUPATIONS**

About 5 million persons are employed in sales occupations. Of this number, about one-fourth are employed on a part-time basis. Salesworkers employed in retail stores account for over one-half of the employment in this occupational group. Most of these workers are women. Almost all persons employed outside of retail trade—in wholesale trade, manufacturing, insurance companies, real estate firms, and other companies—are men.

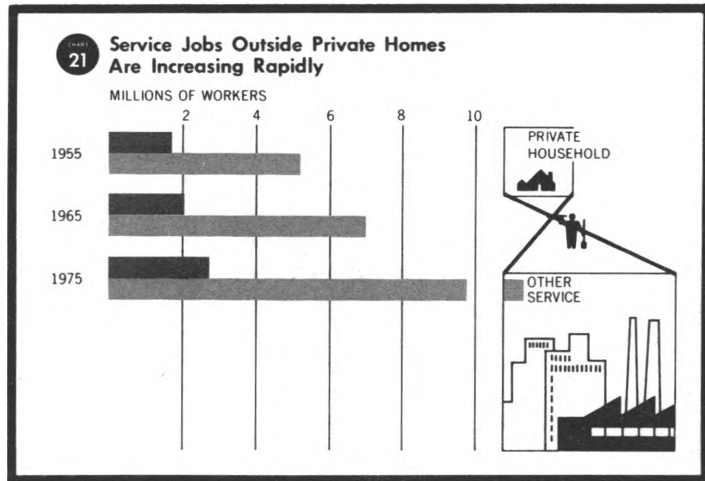
In the 1965-75 period, employment in this occupational group may rise by 25 percent, totaling around 6 million workers. Most of this growth is likely to occur in occupations outside the retail field, among real estate salesmen, insurance agents, manufacturer's salesmen, and others.



**SERVICE OCCUPATIONS**

Private household workers are the largest single group of service workers, accounting for one-fourth of total employment in 1965. Virtually all are women, many of whom work part time as dayworkers and babysitters. Almost as many service workers are employed as waiters, bartenders, and countermaids. This occupational group also includes protective service workers such as FBI agents and policemen who have much more education, on the average, than the group as a whole.

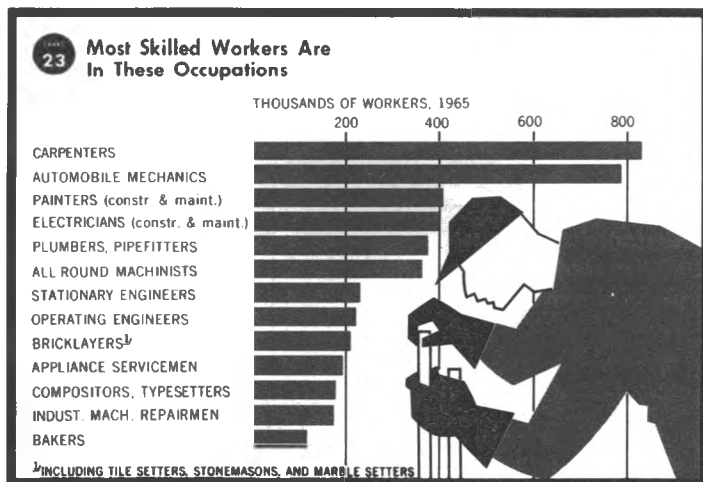
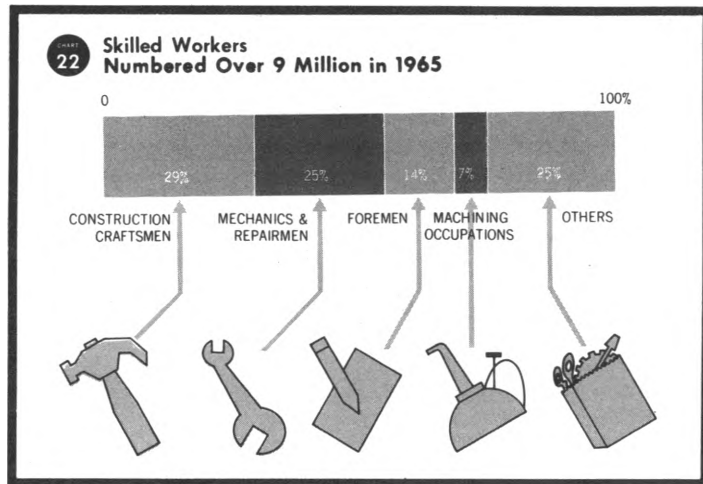
The greatest growth is anticipated among service workers outside of private households, mainly among protective service workers, food service workers, and hospital attendants.

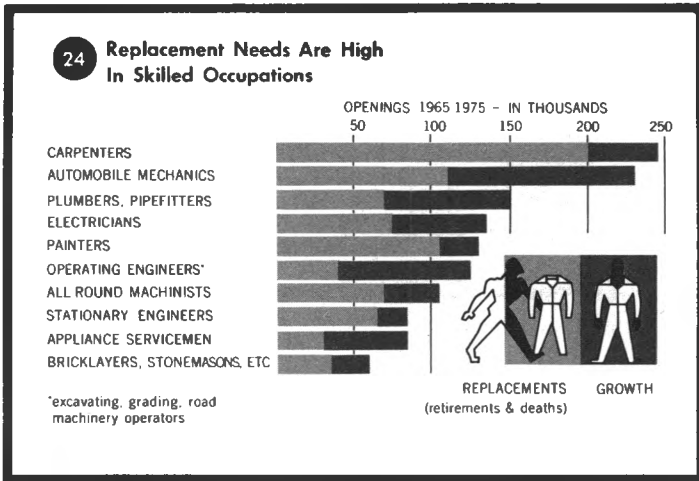


**SKILLED OCCUPATIONS**

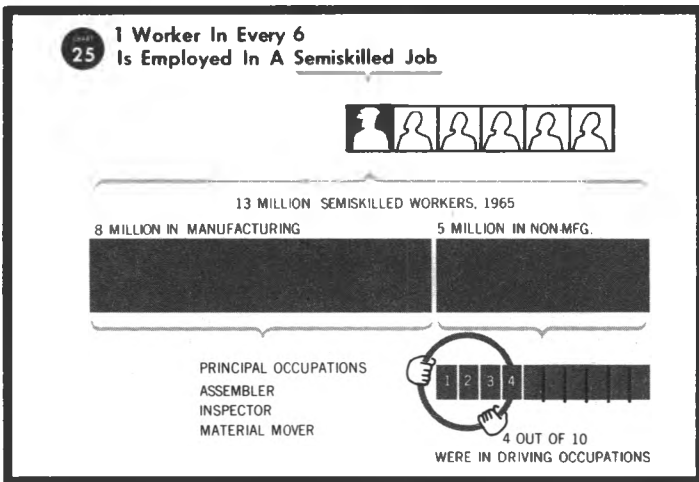
Construction workers, mechanics and repairmen, and machinists make up the majority of the country's skilled work force. New entrants into these fields generally have at least a high school education; many acquire their skills through apprenticeship training programs, through experience gained on the job, and by completing a vocational school curriculum.

Earnings of skilled workers are relatively high, reflecting the level of the work they are required to perform, their extensive training, and the exercise of independent judgment. They generally have more job security, better chances for promotions, and more opportunities to open their own businesses than semiskilled or unskilled workers.





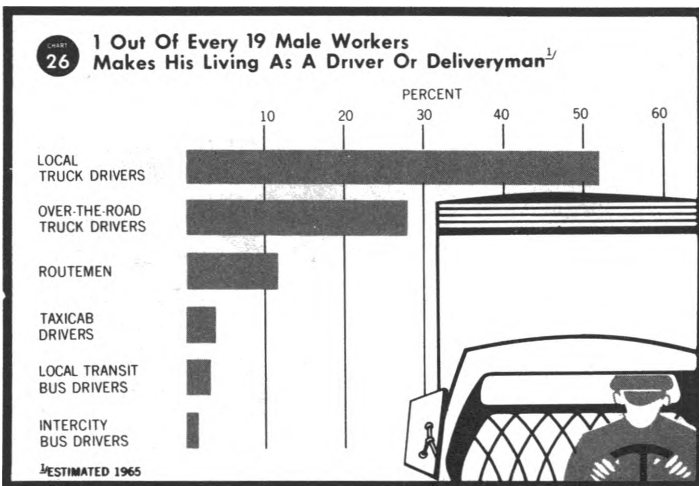
Requirements for skilled workers will rise by nearly one-fourth between 1965 and 1975 from about 9 million to nearly 11½ million. Of the 4 million job openings that are anticipated, slightly over one-half will result from growth in the field and the remainder from deaths and retirements.



Job opportunities will vary greatly among the skilled occupations that make up this group. For example, despite the small employment growth anticipated for carpenters, the greatest number of jobs will be found in this occupation, mainly because of its size and high replacement needs. On the other hand, business machine servicemen, a relatively small occupation, is likely to grow very rapidly. Yet this occupation will offer relatively few employment opportunities.

**SEMISKILLED OCCUPATIONS**

Although employment growth in this group, which includes factory workers as well as operators of motor vehicles, will be less than average between 1965, and 1975, many thousands of job opportunities will be available to young people. This is the largest of all the occupational groups and replacement needs are high.



Drivers and deliverymen account for roughly one out of every five semiskilled workers. Employment of local and over-the-road truckdrivers is expected to grow between 1965 and 1975, offering many employment opportunities for young men seeking to enter the work force.



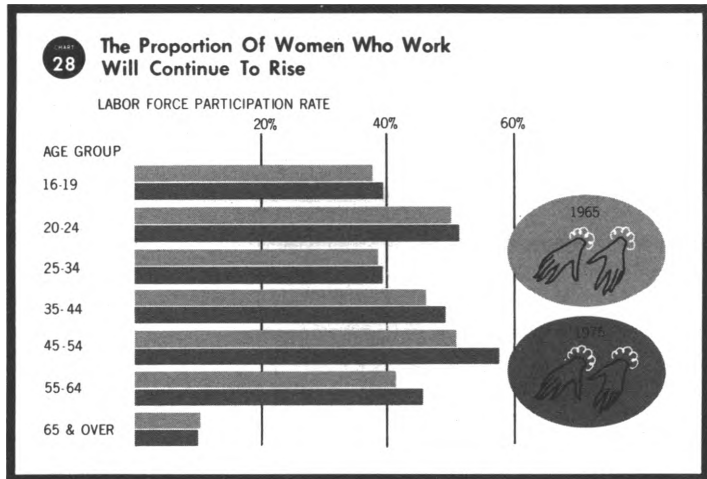
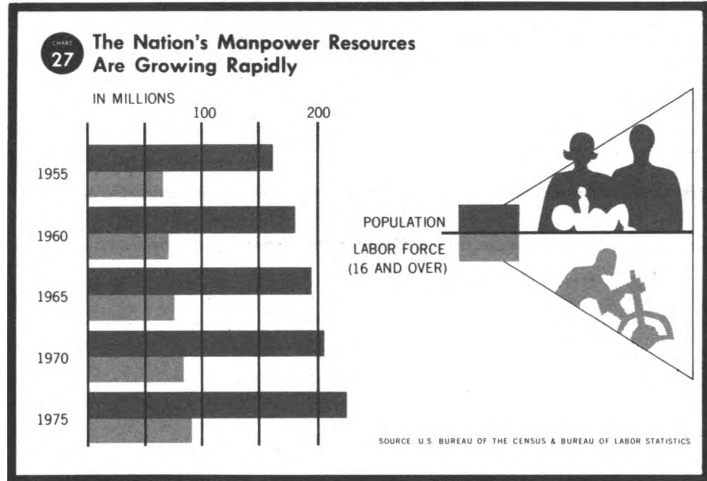
## A LOOK AT FUTURE MANPOWER SUPPLY

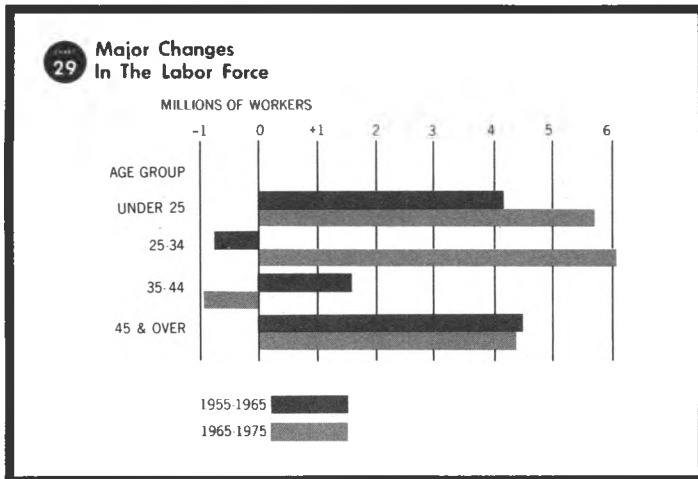
Just as the country's population furnishes the market for most of the goods and services it produces, it also provides the men and women who produce these goods and services.

The labor force, that part of our population age 16 years and over who are working or looking for work, is likely to have a faster rate of growth than our population during the 1965-75 decade, reaching a total of 92 million people.

The rising proportion of women who work will continue to be a major factor (along with the growth in the number of young workers) contributing to the anticipated increase in the labor force. By 1975, women will account for about 36 percent of all workers, compared with 34 percent today.

The highest proportion of working women is found in the 45-54 age group. Slightly over 50 percent of all women in that age group were working in 1965 and almost 60 percent are expected to be working in 1975. About 50 percent of all women between the ages of 20 and 24 will be in the labor force by 1975.



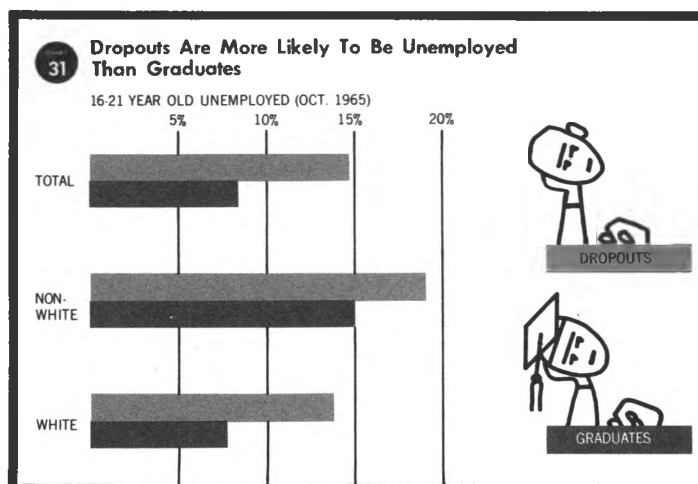
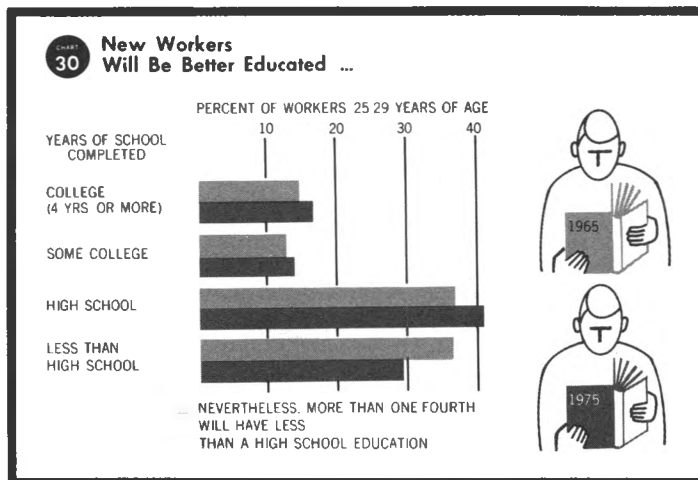


By 1975, one-fourth of all persons between the ages of 16 and 25 will be in the labor force (including the Armed Forces), compared with fewer than one-fifth some 20 years earlier. Thus, the economy will be required to absorb increasing numbers of young persons who must be trained to meet technological and other changes anticipated over the next decade.

The prime working age group (25-34) will increase twice as fast as the labor force between 1965 and 1975. Workers in this age group have been in relatively short supply for many years and actually declined by about 750,000 between 1955 and 1965. The anticipated increase in their numbers will help to alleviate the shortages of well-qualified workers in many occupations.

The workers who will be entering the labor force in the next decade will have more years of schooling than their predecessors. More of them will have completed high school, more will have gone to college, and a smaller proportion will be high school dropouts. Nevertheless, if trends continue, more than a quarter of the new entrants will have less than a high school education.

Aside from the loss of earnings that poorly educated workers will experience over their lifetimes, they will not share in other benefits that stem from a good education: Cultural enrichment; a satisfying way of life, both as workers and as responsible citizens; and other intangible social advantages.



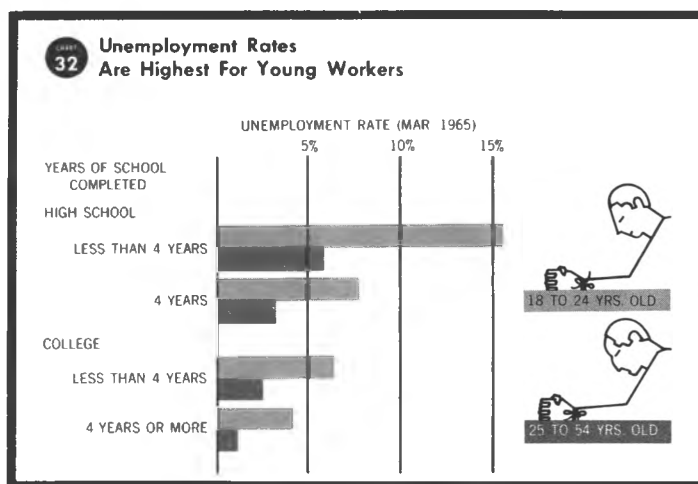
The unemployment rates of young people are much higher at every educational level but dropouts are hit the hardest.

Young people seeking a toehold in the labor force often have difficulties simply because they lack relevant work experience. In addition, they face competition for jobs from other persons who are better educated. Thus, it is not uncommon for young people—regardless of their educational attainment—to experience high levels of unemployment.

## A WORD OF CAUTION

The picture of the future as reflected in the *Handbook* and in these charts is based on four fundamental assumptions:

1. That high levels of economic activity and employment will be maintained over the long run, even though there may be temporary recessions.
2. A defense program similar to that prevailing immediately prior to the Vietnam buildup will exist.
3. That scientific and technological advances will continue.
4. That the institutions and fundamental economic structure of the United States will not change significantly.



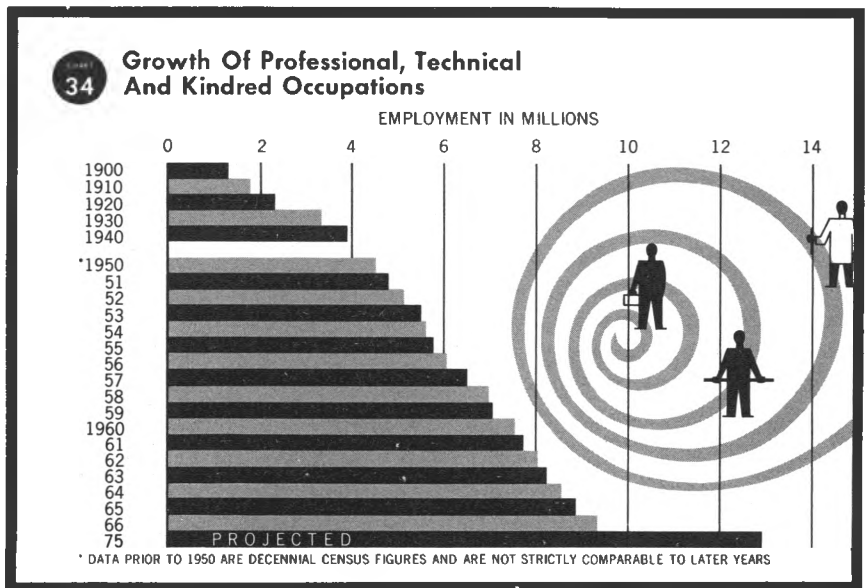
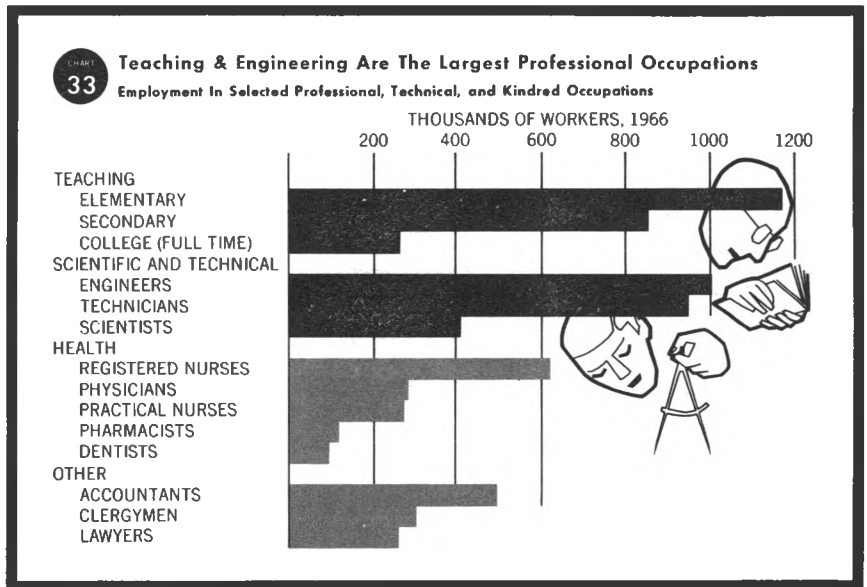


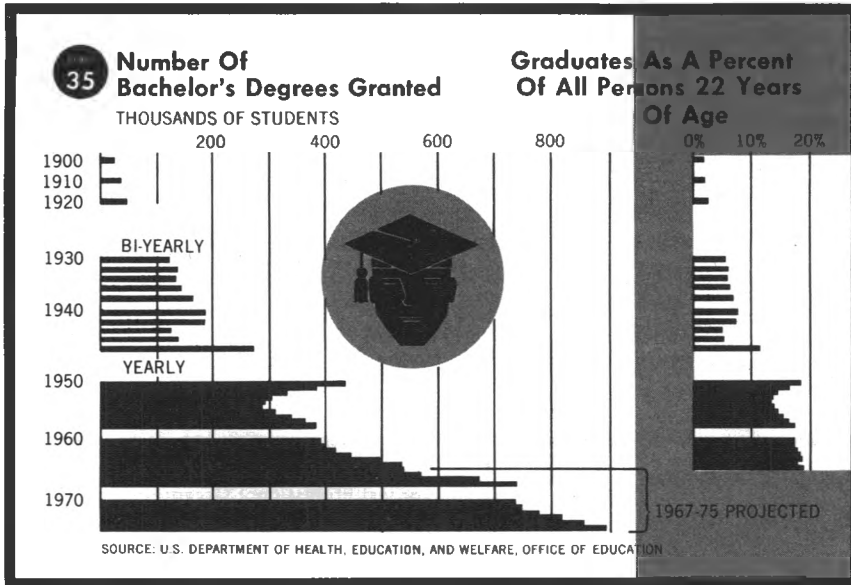
# PROFESSIONAL AND RELATED OCCUPATIONS

Professional occupations have many attractions for young people choosing a career. These occupations offer opportunities for interesting and responsible work and, in many cases, lead to high earnings. As a rule, however, they can be entered only after long periods of specialized education or other preparation, because a broad knowledge of one's field is an essential requirement for success in these types of work.

About 1 out of 8 workers in 1966 was in a professional and related occupation. These occupations—employing more than 9.3 million people—accounted for more than one-fourth of all white-collar employment.

The professions generally require either college graduation—often with an advanced degree—or experience of such kind and amount to provide comparable knowledge. Professional occupations are of two main types. Most professional occupations, including those of engineer, architect, physician, lawyer, and teacher, require specialized, theoretical knowledge of a specific field. The other group, including occupations such as editor and actor, does not require as much specialized, theoretical knowledge, but demands a great deal of creative talent and, also, skill acquired chiefly through experience. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example—with licensing authorities determining the minimum qualifications





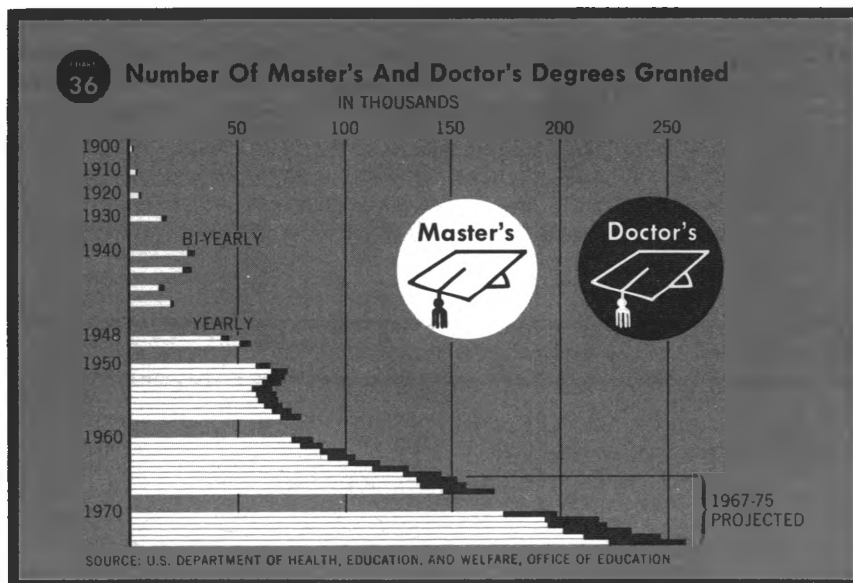
ematicians, physicians, and other professional personnel. Their job titles include those of draftsman; engineering aid; programmer; and electronics, laboratory, or X-ray technician. Employment in these technical occupations usually requires a combination of basic scientific knowledge and specialized education or training in some particular aspect of technology or science. Such training may be obtained in technical institutes, junior colleges, and other schools, or through equivalent on-the-job training.

The major professional and related occupations are shown in chart 33.

### Employment Trends

Employment in professional and related occupations has risen rapidly over the years. From 1.2 million in 1900, the number of these workers has grown to about 9.3 million in 1966. (See chart 34.) Moreover, during the 1950 decade, the rate of growth in the professions was more than twice that for clerical workers, the second fastest growing occupational group at that time. Thus far in the 1960's, growth in the professional and related worker group continues to exceed that of any other broad occupational group.

A major reason for the increase in the total number of workers in professional and related occupations has been the development of various fields, some unknown until recent years. Engineering, mathematics, and other closely related scientific professions have had a spectacular growth over the past 60 years. Other major fields, which have developed wholly or largely during the present century include social work, accounting, personnel work, programing, other data-processing specialties, and electronics. Some of this growth has accompanied the expansion in scientific and engineering professions. As scientific and technical work has become more highly organized, particularly in the laboratories and engineering departments of large firms



which members must have. In addition, professional societies set up membership standards, which tend to define their respective fields.

The professions provide many employment opportunities for women. They represented slightly over one-third of all professional and kindred employment in 1966. In several very large professional occupations—teaching, nursing, library work, and social work—women predominate.

It is not easy to prepare for and enter professional work. Often, institutions do not accept applicants for professional training unless their school grades are high, and employers generally give preference to graduates whose grades are high in their class.

Closely related to the professions is a wide variety of technical occupations. People in these occupations work with engineers, scientists, math-

and in government agencies, more technical assistance has been provided for the professional worker. Similarly, large numbers of technicians and assistants work in the health fields, thereby freeing the professional personnel for work requiring more training.

Between 1966 and 1975, employment in the professional and technical group is expected to rise by nearly 40 percent—about twice the rate for total employment. However, there will continue to be differences in the rates of growth among the professions.

### Educational Trends

Professional occupations accounted for about two-thirds of all workers having a college education in 1966. The concentration of college graduates among these occupations is increasing steadily. In addition to the many professional occupations for which college graduation long has been an entry requirement, the demand for graduates at the entry level in other professional, administrative, and related occupations is increasing. College graduates are now filling many positions which did not exist a few decades ago or which formerly were held by employees because of their experience and personal characteristics.

Emphasis on a college education will be reinforced in the years ahead in view of the growing complexity of modern industry and technology, which is constantly increasing the amount of technical knowledge required for effective performance in many professional and administrative jobs.

A great increase in the number of young men and women graduating from college, which is the chief source of professionally trained workers, has

accompanied the growth in the professional and related occupations. As a percent of all persons 22 years of age, the proportion of young people completing college rose from 2.5 percent in 1920 to 8 percent in 1940, and to 19 percent in 1966, as shown on the inset in chart 35. (The level reached in 1950 is artificially high, reflecting the large number of veterans who went to college under the veterans' education program. In many cases, they would have completed college earlier if it had not been for the war.)

The recent rapid increase in the proportion of young people graduating from college (chart 35) reflects a number of basic social trends. Family incomes are higher, thus more people can afford to postpone 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. Finally, a college education is becoming necessary for an increasing proportion of jobs, and in many professions the amount of education needed is increasing. Since these factors will probably continue to be influential in the future, the proportion of young people who are being graduated from college is expected to go on increasing for many years. The college-age population is also growing. The number of people age 18 to 21 is expected to increase by nearly 3.4 million between 1966 and 1975. These factors, considered together, indicate a great increase in college graduations, assuming that the Nation's colleges and universities build the classrooms, laboratories, dormitories, and other facilities and hire the faculty members needed to provide for the greatly increased numbers of students. The number of bachelor's degrees awarded annually will be about two-thirds greater by

1975 than in 1966. Projections prepared by the U.S. Office of Education in 1966 indicate an increase from about 536,000 bachelor's degrees granted in 1966 to 894,000 in 1975.

The number of students taking graduate training has also risen very rapidly during the last few decades, and will probably continue to mount in the years ahead. A master's degree is usually earned through 1 or 2 years of study beyond the bachelor's degree. The Ph. D. degree usually requires 3 years or more 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 36 shows the vast 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 126,000 in 1966, and are expected to approach 220,000 in 1975, if past trends continue. The number of doctorates awarded (about 17,500 in 1966) may reach 35,000 by 1975.

These projections obviously imply a great increase in the supply of personnel which will be available for professional employment. Since the overall 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 late 1960's and early 1970's for the better professional positions in at least some fields of work.

## BUSINESS ADMINISTRATION AND RELATED PROFESSIONS

Many professional workers play a major role in administering businesses and a wide variety of other organizations, both private and governmental. People in these occupations generally need a college degree to qualify for work in their respective fields. Though their disciplines are oriented toward business management, they perform functions which are highly specialized and varied. Whether their organizations are small or large, employing only a few people or many thousands, the decisions they reach and their effectiveness in getting these decisions carried out contribute greatly to the success or failure of the enterprise.

This chapter describes a few selected professional occupations that are of vital importance to the Nation's businesses—accountants, advertising workers, marketing research workers, personnel workers, and public relations workers. Workers engaged primarily in managerial duties are covered in the section on *Managerial Occupations* elsewhere in the *Handbook*.

### ACCOUNTANTS

(D.O.T. 160.188)

#### Nature of Work

Accountants compile and analyze business records and prepare finan-

cial reports, such as profit and loss statements, balance sheets, cost studies, and tax reports. The major fields of specialization are public, management (private), and government accounting. Public accountants are independent practitioners who work on a fee basis for business enterprises or for individuals wishing to use their services, or as a member or employee of an accountancy firm. Management accountants, often referred to as industrial or private accountants, handle the financial records of the particular firm for which they work on a salary basis. Government accountants work on the financial records of government agencies and often audit the records of private business organizations and individuals whose dealings are subject to government regulations.

Accountants in any field of employment may specialize in such areas as auditing, taxes, cost accounting, budgeting and control, information processing, or systems and procedures. Public accountants are likely to specialize in auditing—that is, in reviewing financial records and reports and giving opinions as to their reliability. They also advise clients on tax matters and other financial and accounting problems. Most management accountants are involved in some aspects of providing management with information for decision making. Sometimes they specialize in taxes, budgeting or in internal auditing—that is, examining and appraising financial systems and management control procedures in their company. 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

Accountants numbered about 500,000 in early 1967, of whom about 100,000 were certified public accountants. Accounting is one of the largest fields of professional employment for men. Only about 2 percent of the

CPA's, and less than 10 percent of all accountants are women.

Nearly three-fifths of all accountants do management accounting work for the business and industrial firms that employ them. An additional one-fifth are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. Over 10 percent work for Federal, State and local government agencies. A small number teach in colleges and universities.

Accountants are employed wherever business, industrial, or governmental organizations are located. The majority, however, work in large metropolitan centers where there is a particularly heavy concentration of public accounting firms and central offices of large business organizations.

#### Training, Other Qualifications, and Advancement

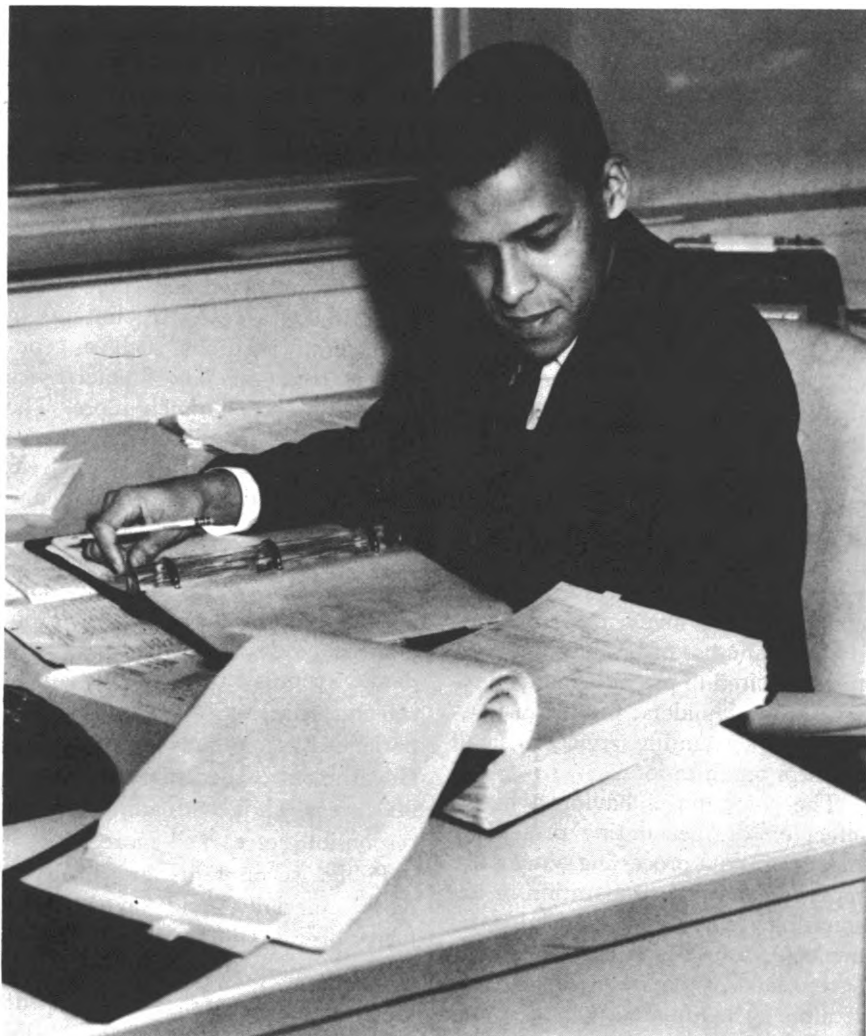
Training in accounting can be obtained in universities, 4-year colleges, junior colleges, accounting and private business schools, and correspondence schools. Graduates of all these institutions are included in the ranks of successful accountants; however, a bachelor's degree with a major in accounting or a closely related field is increasingly an asset, and for better positions it may be required. Candidates with a master's degree in accounting, as well as college training in other business and liberal arts subjects, are preferred by many firms. Previous work experience can be of great value also, in qualifying for employment. A number of colleges offer students an opportunity to get such experience through internship programs conducted in cooperation with public accounting or business firms. For beginning accounting positions, the Federal Government requires 4 years of college training (including 24 semester hours in accounting) or an equivalent combination of education and experience. Most universities require the master's degree or the doctorate with the Certified Public



Accountancy Certificate for teaching positions.

All States require that anyone practicing in the State as a "certified public accountant" hold a certificate issued by the State board of accountancy. Well over half the States also restrict the title "public accountant" to those who are licensed or registered. Requirements for licensing and registration vary considerably from one State to another, and information on these requirements may be obtained directly from the board of accountancy in the State where the student plans to practice. Almost half the States have laws that will, by 1970, require CPA candidates to be college graduates. All States use the CPA examination provided by the American Institute of Certified Public Accountants. In recent years, more than 9 out of 10 successful CPA candidates have been college graduates. Before the CPA certificate is issued, at least 2 years of public accounting experience, or its equivalent, is required in nearly all States.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to detailed work such as verifying cash balances or inspecting vouchers. They may advance to semisenior positions in 1 or 2 years and to senior positions within another 1 or 2 years. In the larger firms, those successful in dealing with top industry executives often become supervisors, managers, or partners, or transfer to executive positions in private accounting. Some become independent practitioners. Beginners in management accounting may start as ledger accountants, junior internal auditors, or as trainees for technical accounting positions. They may rise to chief plant accountant, chief cost accountant, budget director, senior internal auditor, or manager of internal auditing, depending on their specialty. Some become controllers, treasurers, or corporation presidents. In the Federal Government, beginners are hired as trainees and usually are promoted in a year or so. In colleges and universities, those with minimum training



Accountant analyzes financial records.

and experience may receive the rank of instructor without tenure; advancement and permanent faculty status are dependent upon further education.

Accountants who want to get to the top in their profession usually find it necessary to continue their study of accountancy and related problems—even though they already may have obtained college degrees or CPA certificates. Even experienced accountants may spend many hours in study and research in order to keep abreast of legal and business developments that affect their work. More and more accountants are studying computer operation, programing, mathematics, and quantitative meth-

ods in order to adapt accounting procedures to new methods of processing business data. Although advancement may be rapid for capable accountants, those with inadequate academic preparation are likely to be assigned to routine jobs and find themselves handicapped in obtaining promotion.

### Employment Outlook

Employment opportunities for accountants are expected to be excellent through the 1970's. As many as 12,000 accountants may be needed annually during this period to replace those who retire, die, or transfer to other occupations. Provided no major set-

back occurs in the general level of business activity, at least an equal number of accountants probably will be needed each year due to growth in the occupation. Demand for college-trained accountants will rise faster than demand for people without this broad background of training, because of the growing complexity of business accounting requirements. However, graduates of business and other schools which offer thorough training in accounting should have good job prospects during this period, also.

Accounting employment is expected to expand rapidly in the 1970's because of such factors as the greater use of accounting information in business management; complex and changing tax systems; the growth in size and number of business corporations required to provide financial reports to stockholders; and the increasing use of accounting services by small business organizations.

The computer is having a major effect on the accounting profession. Electronic data processing systems are replacing manual preparation of accounting records and financial statements. As a result the need for junior accountants at the lower level may be reduced or eliminated. On the other hand, computers can process vast quantities of routine data which will require the employment of additional accountants so that these data can be analyzed. Also, the computer is expected to bring about radical changes in management information systems and decisionmaking processes in large companies. Additional highly-trained accountants will be required to prepare, administer and analyze the information made available by these systems.

### Earnings and Working Conditions

Starting salaries for new college graduates averaged about \$7,000 a year in 1966 according to a private survey of large business organizations recruiting for accounting positions.

Smaller firms, especially the small CPA firms, generally pay lower starting salaries.

Average earnings of experienced accountants, in other than public accounting, ranged between \$7,300 and \$12,300 a year in 1966 according to information provided from a Bureau of Labor Statistics study. Chief accountants averaged between \$11,000 and \$18,000 a year. Accountants in managerial positions such as controllers, treasurers, and financial vice presidents earned much more. The earnings of self-employed accountants vary depending on factors such as their qualifications, experience, and clientele.

In the Federal Civil Service, the entrance salary for junior accountants and auditors was \$6,211 in 1966. Some candidates with superior academic records could qualify for a starting salary of \$7,090. Many experienced accountants in the Federal Government earned more than \$11,000 a year. Those with administrative responsibilities earned more.

Public accountants are likely to work especially long hours under heavy pressure during the tax season. They do most of their work in their clients' offices, and sometimes do considerable traveling to serve distant clients. A few management and government accountants also do a great deal of traveling and work irregular hours, but the majority remain in one office and work between 35 and 40 hours a week, under the same general conditions as their fellow office workers.

### 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, 666 Fifth Ave., New York, N.Y. 10019.

Further information on specialized fields of accounting may be obtained from:

National Association of Accountants,  
505 Park Ave., New York, N.Y.  
10022.

Financial Executives Institute, 50  
West 44th St., New York, N.Y.  
10036.

The Institute of Internal Auditors,  
Inc., 60 Wall St., New York,  
N.Y. 10005.

Information describing accounting as a career may be obtained free from:

Accounting Careers Council, National  
Distribution Center, P.O. Box  
650, Radio City Station, New  
York, N.Y. 10010.

### ADVERTISING WORKERS

(D.O.T. 050.088; 132.088; 141.081;  
through .168; 164.068 through .168;  
and 219.488)

#### Nature of Work

Through advertisements published in newspapers and magazines, broadcast on the radio, shown on television, displayed on billboards, sent through the mail, or even written in smoke in the sky, businessmen try to reach potential customers and persuade them to buy their products or services. Advertising workers plan and prepare these advertisements and get them before the public. They include executives responsible for planning and overall supervision, copywriters who write the text, artists who prepare the illustrations, layout specialists who put copy and illustrations into the most attractive arrangement possible, administrative and technical workers who are responsible for the satisfactory reproduction of the "ads," and salesmen who sell advertising space in publications or time on radio and television programs. In a very small advertising organization, one person may do all these things. Large organizations employ specialists for

research, copywriting, and layout work. They sometimes have staff members who specialize in writing copy for particular kinds of products or for one type of advertising media such as radio, popular magazines, or direct mail. The following are the specialized occupations most commonly found in advertising work.

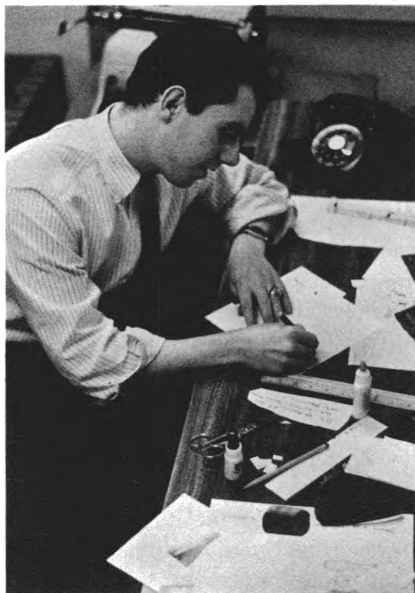
*Advertising managers* head the advertising departments of manufacturing companies and other advertisers and of newspapers and other media. Since most businesses use the services of advertising agencies to handle all or part of their advertising programs, the company's advertising manager works mostly on policy questions—for example, the type of advertising, the size of the advertising budget, and the agency to be employed. He then works with the agency in planning and carrying through the program. He may also supervise the preparation of special sales brochures, display cards, and other promotional materials.

The advertising manager of a newspaper, radio station, or other advertising medium is concerned chiefly with selling advertising time or space; his functions are similar to those of the sales manager in other businesses.

*Account executives* are employed in advertising agencies to handle relations between the agency and its clients. An account executive studies the client's sales and advertising problems, develops a plan to meet the client's needs, and seeks his approval of the proposed program. Account executives must be able to sell ideas and maintain good relations with clients. They must know how to write copy and use artwork, even though copywriters and artists usually carry out their ideas and suggestions.

Some advertising agencies have account supervisors who oversee the work of the account executives. In others, account executives are directly responsible to agency heads.

*Advertising copywriters* create the headlines, slogans, and text that attract buyers. They collect information about the products and the people who might use them. They use



Copywriter develops new advertising slogan.

psychology and writing techniques to prepare copy especially suited for readers or listeners and for the type of advertising medium to be used. Copywriters may specialize in copy that appeals to certain groups—housewives, businessmen, scientists, or engineers—or even in copy that deals with specific products such as lipsticks or washing machines. In advertising agencies, copywriters work closely with account executives, although they may be under the supervision of a copy chief.

Advertisers and advertising agencies employ *media directors* (or *space buyers* and *time buyers*) to determine where and when advertising should be carried to reach the largest group of prospective buyers at the least cost. They must have a vast amount of information about the cost of advertising in all media and the relative size and characteristics of the reading or listening audience which can be reached in various parts of the country by specific publications, broadcasting stations, and other media.

*Production managers* and their assistants arrange to have the final copy and artwork converted into printed form. They deal with printing, engraving, and other firms involved in

the reproduction of advertisements. The production manager must have a thorough knowledge of various printing processes, typography, photography, paper, inks, and related technical materials and processes.

*Research directors* and their assistants assemble and analyze information needed for effective advertising programs. They study the possible uses of the product, its advantages and disadvantages compared with competing products, and the best ways of reaching potential purchasers. Such workers may make special surveys of the buying habits and motives of customers, or may try out sample advertisements to find the most convincing selling theme or most efficient media for carrying the advertising message. The research director is an important executive in advertising organizations. More information on this occupation is contained in the statement on Marketing Research Workers.

*Artists and layout men* are part of a key creative group in advertising work. They work closely with advertising managers, copywriters, and other advertising personnel in planning advertisements. More information about this group appears in the separate statements on Commercial Artists and on Photographers.

### Where Employed

In early 1967, more than 125,000 men and women were employed in professional or other positions requiring considerable knowledge of advertising. Perhaps a third of these workers are employed in advertising agencies, and more than half of the agency workers are employed in the New York City and Chicago metropolitan areas. However, there are many independent agencies in other cities, and many leading agencies operate branch offices outside the major centers.

Advertising workers not employed in advertising agencies work for manufacturing companies, stores, and other organizations having prod-

ucts or services to sell; for advertising media, such as newspapers and magazines; and for printers, engravers, art studios, product and package designers, and others who provide services to advertisers and advertising agencies.

### **Training, Other Qualifications, and Advancement**

Most employers, in hiring advertising trainees, prefer college graduates with liberal arts training or majors in marketing, journalism, or business administration. However, there is no typical educational background for success in advertising. Some successful advertising people have had no college training; others started in such varied occupations as engineer, teacher, chemist, artist, or salesman.

Most advertising jobs require a flair for language, both spoken and written. Since every assignment requires individual handling, a liking for problem-solving is also very important. Advertising personnel should have a great interest in people and things, to help them sell their ideas to their superiors, to advertisers, and to the public. They must be able to accept criticism and to gain important points with tact.

Young people planning to enter the advertising field should get experience in copywriting or other work for their school publications and, if possible, through summer jobs in selling, interviewing, or other work connected with marketing research services. Some large advertising organizations recruit outstanding college graduates and train them through programs which cover all aspects of advertising work. Most beginners, however, have to locate their own jobs by applying directly to possible employers. Young men sometimes begin as mail clerks, or as messengers and runners who pick up and deliver messages and proofs for departments and agency clients. Some start as assistants in research or production work or as space or time buyers. A few begin as junior copy-

writers. In most advertising organizations, women begin as secretaries or, if they have the required education, as research assistants. The best avenue of entrance to advertising work for women is through advertising departments in retail stores.

Employees with initiative, drive, and talent may progress from beginning jobs to creative, research, or managerial work. Management positions require experience in all phases of the advertising business including some work with advertising agencies, media, and advertisers.

Copywriters and account executives can usually look forward to rapid advancement if they demonstrate exceptional ability in dealing with clients, since the success of an advertising organization depends upon satisfied advertisers. Many of these workers prefer to remain in their own specialties and for them advancement is to more responsible work at increased pay. Some topflight copywriters and account executives establish their own agencies.

### **Employment Outlook**

Advertising attracts many young people; those seeking entry will face stiff competition through the 1970's. Good opportunities, however, will continue for those who have the background and aptitude.

Employment in advertising is expected to increase rapidly during the rest of the 1960's and through the 1970's. Among the factors that will contribute to the demand for advertising workers are the overall growth of industry, the development of new products and services, and the increase in competition among producers of industrial and consumer goods. In addition to those needed to fill new positions, several thousand advertising workers will be needed each year to replace those who transfer to other types of work, or who retire, die, or leave the field for other reasons. The greatest demand is likely to occur in advertising agencies, since advertisers are turning over more and

more of their advertising work to agencies.

### **Earnings and Working Conditions**

Starting salaries for beginning advertising workers ranged from \$4,000 to \$8,000 per year in 1966-67 according to the limited information available. The higher salaries were most frequently paid in very large firms recruiting outstanding college graduates; the lower salaries were received in stores and small advertising agencies.

Salaries of workers above the trainee level are also likely to be highest in the largest firms. A private survey reports that the salaries of copywriters ranged from \$8,000 to \$20,000 annually; account executives, salaries from \$15,000 to \$25,000; and those of senior media buyers from \$8,000 to \$15,000 a year. Copy chiefs, account supervisors, media directors and other top agency executive personnel often receive substantially higher salaries. For example, the reported earnings for advertising agency creative directors ranged from \$20,000 to \$70,000 a year. The earnings of advertising managers and directors employed by firms other than advertising agencies ranged from \$8,000 to \$30,000 annually. The wide spread in the salaries reported reflects the great differences in experience, talent, function, and degree of responsibility among workers who have the same job title.

Advertising workers frequently work under great pressure. Working hours are sometimes irregular, because publication deadlines must be met and last minute changes are not uncommon. People in creative jobs often work evenings and weekends to finish important assignments.

At the same time, advertising offers a satisfying career to people who enjoy variety, excitement, and a constant challenge to their creative ability, and who can meet the competition. Advertising workers have the satisfaction of seeing their work in print or hearing it over the radio

or television even though they remain unknown to the public at large.

### Where To Go for More Information

American Advertising Federation,  
655 Madison Ave., New York,  
N.Y. 10021.

American Association of Advertising  
Agencies, 200 Park Ave., New  
York, N.Y. 10017.

## MARKETING RESEARCH WORKERS

(D.O.T. 050.088)

### Nature of Work

Businessmen make decisions daily regarding the marketing of their goods and services. Marketing research workers help to increase the fund of information upon which these basic business decisions are made. They act as factfinders—seeking out, analyzing, and interpreting many different kinds of information. They prepare reports and recommendations to help management make decisions on such widely differing problems as forecasting sales; selecting a brand name, package, or design; choosing a new plant location; deciding whether to move goods by rail, truck, or other method; and determining the kinds of advertising likely to attract the most business. In investigating these and other problems, they consider expected changes in population, income levels, and consumer credit policies, or other subjects relevant to marketing policies.

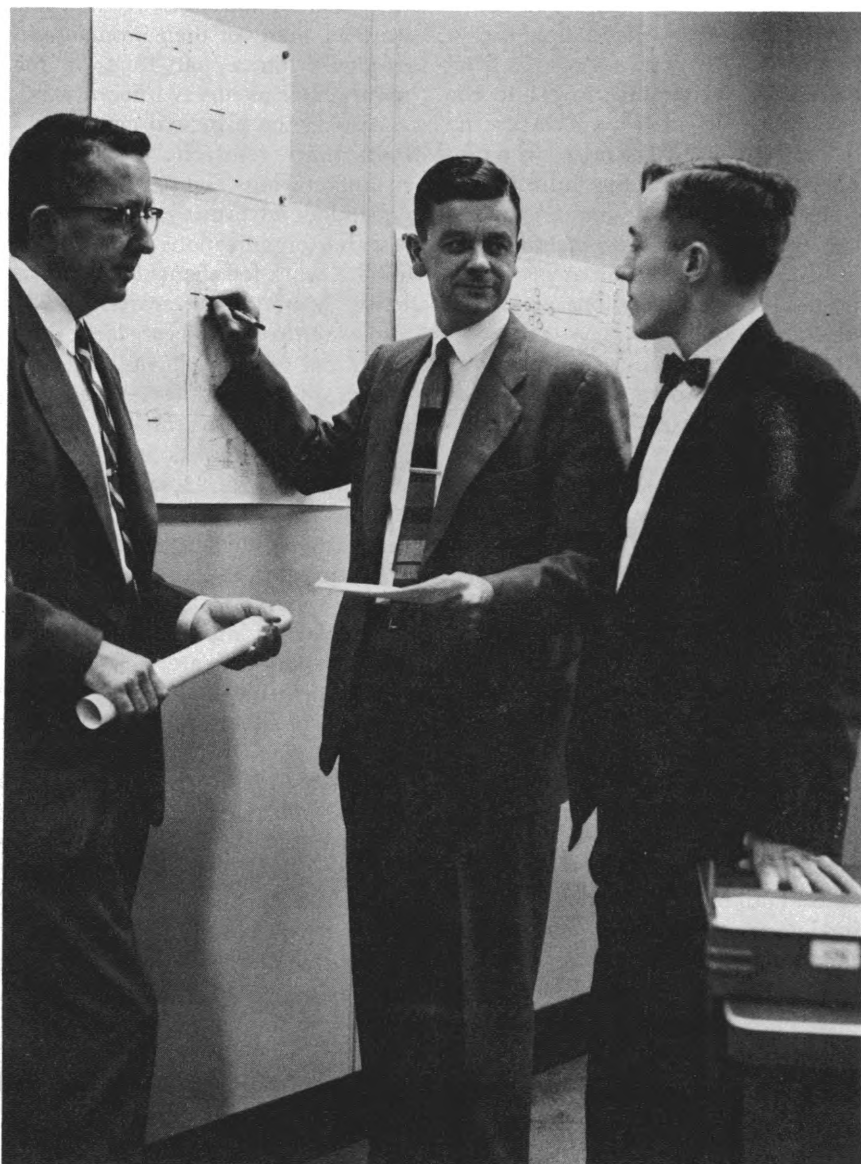
Most marketing research starts with the collection of facts from published materials, from the firm's own records, and from specialists on the subject under investigation. For example, research workers analyzing the fluctuations in a company's sales, may first study sales records in a number of different cities to determine periodical changes in sales volume. They may then compare these changes with changes in population, income levels, the size of the com-

pany's sales force, and the amounts spent by the company for advertising in each city and, from these comparisons, discover the reasons for changes in the volume of sales. Other marketing research workers may study changes in the quantity of company goods on store shelves, or make door-to-door surveys to learn how many company products already are used in households.

Marketing research is often concerned with the personal opinions of the people who are using company

products or who might use them in the future. For example, a survey intended to help management decide on the design and pricing of a new line of television sets may involve the use of a questionnaire to learn from a limited number of consumers the price they would be willing to pay and their preferences in such things as the color and size of the set.

A survey of this kind is usually carried on under the supervision of marketing research workers who specialize in research on consumer



Marketing research workers appraise success of new product.

goods—that is, merchandise sold to the general public. In planning the survey, the marketing research worker may get help from a statistician in selecting a group (or “sample”) of individuals to be interviewed, in order to be confident that the opinions obtained from them represent those held by the many other potential customers. He may also consult a specialist in “motivational research”—an expert in framing questions that will produce reliable information about the motives that lead people to make the purchases they do. When the investigation gets underway, the marketing research worker may supervise a number of interviewers who call on consumers to obtain answers to the questions. He also may direct the work of the office employees who tabulate and analyze the information collected. His report summarizing the survey findings also may include other information that company officials need in making decisions about the new line.

Marketing research surveys concerned with products used by business and industrial firms may be conducted somewhat differently from consumer goods surveys. Because research on some industrial products requires interviewers with a technical knowledge of the product involved, the interviews are often conducted by the marketing research worker himself (or by several research workers, if the survey is a particularly extensive one). In his interviews, the worker not only tries to get opinions about the proposed product, but keeps on the lookout for possible new ways of adapting it to industrial needs. He must, therefore, be a specialist both in marketing research and in the industrial uses of the product involved.

### Where Employed

About 20,000 marketing research workers were estimated to be employed full time in 1967. This number included research assistants and

others in junior positions, who helped experienced analysts collect information and prepare reports, as well as research supervisors and directors. The majority of these workers were men; positions held by women were most frequently at the junior professional levels.

In addition to these marketing research workers, a limited number of other professional employees (statisticians, economists, psychologists, and sociologists) and several thousand clerical workers (clerks who code and tabulate survey returns, typists, and others) were employed full time in this field. Thousands of additional workers, many of them women, were employed on a part-time or temporary basis as survey interviewers.

Among the principal employers of marketing research workers are manufacturing companies and independent advertising and marketing research organizations which do this kind of work for clients on a contract basis. Marketing research workers also are employed by very large stores, radio and television firms, and newspapers; others work for university research centers, government agencies, and other organizations which provide information for businessmen. Marketing research organizations range in size from one-man enterprises to large firms with a hundred employees or more.

The largest number of marketing research workers are in New York City, where many major advertising and independent marketing research organizations are located and where many large manufacturers have their central offices. The second largest concentration is in Chicago. However, marketing research workers are employed in many other cities—wherever there are central offices of large manufacturing and sales organizations.

### Training, Other Qualifications, and Advancement

A bachelor's degree is usually required to enter trainee positions in

marketing research. A master's degree in business administration is becoming increasingly desirable, especially for advancement to higher level positions. Many people qualify for positions in marketing research through experienced gained in other kinds of research jobs or in work related to the field of marketing. University teachers with experience in teaching, marketing research, or statistics sometimes are sought by employers to head new marketing research departments.

Among the college courses considered valuable as preparation for work in marketing research are marketing, statistics, English composition, speech, psychology, and economics. Candidates for some marketing research positions need specialized training in engineering or other technical subjects, or a substantial amount of sales experience and a thorough knowledge of the company's products. A knowledge of electronic data-processing procedures is becoming important because of the growing use of electronic computers in sales forecasting, distribution, cost analysis, and other aspects of marketing research. Graduate training may be necessary for some kinds of work—for example, motivational research or sampling and other statistical work connected with large-scale surveys.

Trainees in marketing research usually start as research assistants or junior analysts. At first, they are likely to do considerable clerical work, such as copying information from published sources, editing and coding questionnaires, and tabulating results of questionnaires returned in surveys. They also learn how to conduct interviews and how to write reports on survey findings.

After a few years of experience, assistants and junior analysts may advance to higher level positions, with responsibility for specific marketing research projects, or to supervisory positions. An exceptionally able individual may eventually become marketing research director or vice president in charge of marketing and sales.

Marketing research workers must have exceptional ability in recognizing and defining problems, and imagination and ingenuity in applying marketing research techniques to their solution. Above all, this work calls for the ability to analyze information and to write reports which will convince management of the significance of the information.

### Employment Outlook

College graduates well prepared in marketing research methods and statistics are likely to find very good job opportunities in this growing occupation through the 1970's. It is expected that existing marketing research organizations will expand and that many new marketing research departments and new independent research firms will be set up. In addition to growth needs, many openings will occur each year as persons retire, die, or leave the field for other reasons.

The demand for marketing research services is expected to increase during the next 10 years as the constant stream of new products heightens competition for customers. Business managers will find it increasingly important to obtain the best information possible for appraising marketing situations and planning marketing policies. As marketing research techniques improve and more statistical data accumulate, company officials are likely to turn to marketing research workers for information and advice with increasing frequency.

### Earnings and Working Conditions

Annual starting salaries for market research trainees averaged about \$6,900 in 1967, according to the limited data available. People with master's degrees in related fields usually started at higher salaries.

Earnings are substantially higher for experienced marketing research workers who attain positions with considerable responsibility. For ex-

ample, in 1966, earnings of marketing research directors averaged about \$16,000; earnings of senior analysts generally ranged between \$12,000 and \$15,000 a year.

Marketing research workers usually work in modern, centrally located offices. Some, especially those employed by independent research firms, do a considerable amount of traveling in connection with their work. Also they may frequently work under pressure and for long hours to meet deadlines.

### Where To Go for More Information

Information about specialized types of marketing research is contained in a report entitled "Selecting Marketing Research Services" which may be obtained from:

Small Business Administration,  
Washington, D.C. 20416.

Additional information on marketing research may be obtained from:

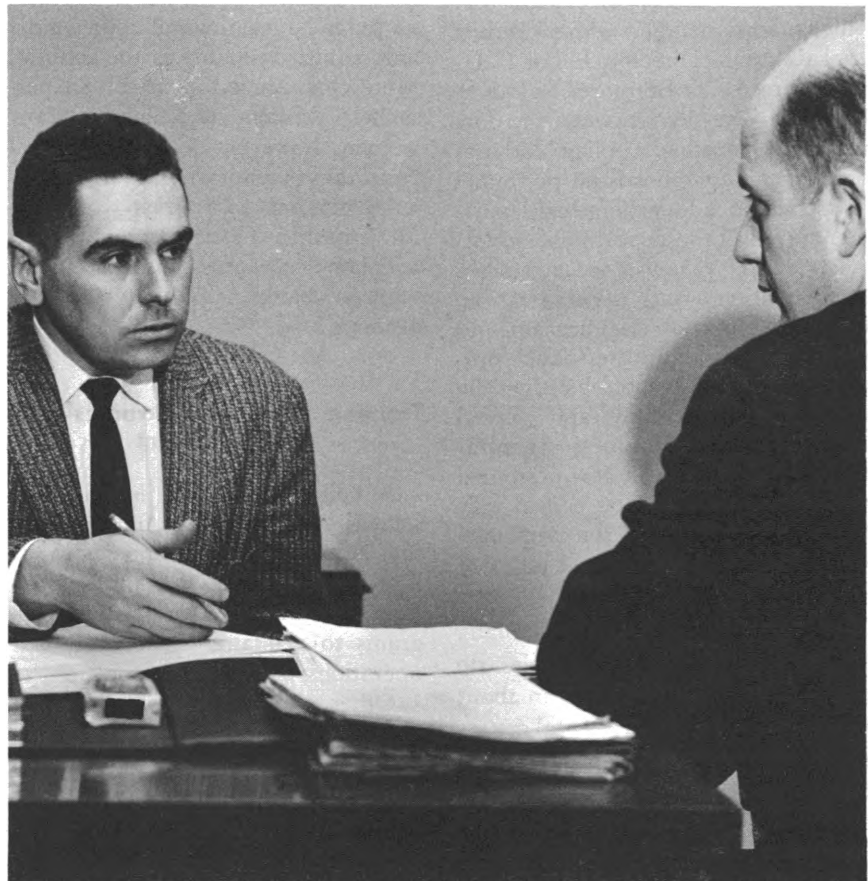
American Marketing Association,  
230 North Michigan Ave., Chicago,  
Ill. 60601.

### PERSONNEL WORKERS

(D.O.T. 166.088 through .268 and 169.118 and .168)

### Nature of Work

Attracting and keeping the best employees available, and matching them to jobs they can do effectively are important for the successful operation of business and government. Personnel workers are responsible for helping their employers attain these objectives. They develop recruiting and hiring procedures, interview job applicants, and select and recommend



Interviewing job applicants is an important responsibility in personnel work.

the ones they consider best qualified for the openings to be filled. In addition, personnel workers counsel employees, deal with disciplinary problems, classify jobs, plan wage and salary scales, develop safety programs, and conduct research in personnel methods. Employee training, the administration of retirement and other employee benefit plans, and labor-management relations—including the negotiation of agreements with unions—are also important aspects of their work.

Many personnel jobs require only limited contact with people; others involve frequent contact with employees, union representatives, job applicants, and other people in and outside the company.

Business organizations with large personnel departments employ personnel workers in many different levels of responsibility. Usually, the department is headed by an executive with the title of Personnel Director; other titles sometimes used are Industrial Relations Director, Labor Relations Director, or Employee Relations Director. The department head formulates personnel policy, advises other company officials on personnel matters, and administers his department. Within the department, supervisors and various specialists—in labor relations, wage administration, training, safety, job classification, and other aspects of the personnel program—may be responsible for the work of staff assistants and clerical employees. Small business organizations employ relatively few personnel workers. Sometimes one person may be responsible for all the personnel activities as well as other types of duties.

Personnel workers in Federal, State, and local government agencies do much the same kind of work in about the same kind of departmental organization as do those employed in large business firms. Government personnel workers, however, spend considerably more time in activities related to classifying jobs, and in devising, administering, and scoring the competi-

tive examinations given to job applicants.

### Where Employed

Personnel workers are employed in nearly all kinds of business enterprises and government agencies. The total number employed in 1967 was estimated to be more than 100,000. Well over half of all personnel workers were employed by private firms. Large numbers also were employed by Federal, State, and local government agencies. A small group of personnel workers were in business for themselves, often as management consultants or labor relations experts. In addition, colleges and universities employed some professionally trained personnel workers as teachers of courses in personnel administration, industrial relations, and similar subjects.

Most personnel workers are employed in large cities and in the highly industrialized sections of the country. More than three-fourths of all personnel workers are men. Many women, however, occupy personnel positions in organizations that employ large numbers of women workers—for example, in department stores, telephone companies, insurance companies, banks, and government agencies.

### Training, Other Qualifications, and Advancement

A college education is becoming increasingly important for entrance into personnel work. Some employers hire new graduates for junior positions, and then provide training programs to acquaint them with their operations, policies, and problems.

Other employers prefer to fill their personnel positions by transferring people who already have firsthand knowledge of operations, such as employees in industrial engineering production supervision, and payroll accounting positions. A large number of the people now in personnel work

who are not college graduates entered the field in this way.

College graduates with a major in personnel administration are preferred for beginning positions by many employers in private industry; graduates with a general business administration background are preferred by others. A liberal arts education is considered the most desirable preparation for personnel work by still other employers. Young people interested in personnel work in government are often advised to major in public administration, political science, or personnel administration; however, those with other college majors also are eligible for personnel positions in government.

For some positions, more specialized training may be necessary. Jobs involving testing or employee counseling often require a bachelor's degree with a major in psychology and sometimes a graduate degree in this field. An engineering degree may be desirable for work dealing with time studies or safety standards, and a degree with a major in industrial relations may be helpful for work involving labor relations. A background in accounting may be useful for positions concerned with wages, or pension and other employee benefit plans.

After the initial period of orientation, through formal or on-the-job training programs, college graduates may progress to classifying jobs, interviewing applicants, or handling other personnel functions. After they have gained experience, those with exceptional ability may be promoted to executive positions such as that of personnel director. Personnel workers sometimes advance by transferring to other organizations with larger personnel programs or from a middle-rank position in a big corporation to the top job in a smaller one.

Personal qualities regarded as important for success in personnel work include the ability to speak and write effectively and a better-than-average aptitude for working with



people of all levels of intelligence and experience. In addition, the prospective personnel worker should be the kind of person who can see the employee's point of view as well as the employer's, and should be able to give advice in the best interests of both. A liking for detail, a high degree of persuasiveness, and a pleasing personality are important also.

### Employment Outlook

College graduates are expected to find many opportunities to enter personnel work through the 1970's. While employment prospects will probably be best for college graduates who have specialized training in personnel administration, positions will be available also for people with degrees in other fields. Opportunities for young people to advance to personnel positions from production, clerical, or subprofessional jobs will be limited.

Employment in personnel work is expected to expand rapidly as the Nation's employment rises. More personnel workers will be needed to carry on recruiting, interviewing, and related activities. Also, many employers are recognizing the importance of good employee relations, and are depending more heavily on the services of trained personnel workers to achieve this.

Employment in some specialized areas of personnel work will rise faster than others. More people will probably be engaged in psychological testing; the need for labor relations experts to handle relations with unions will probably continue to increase; and the growth of employee services, safety programs, pension and other benefit plans, and personnel research also is likely to continue.

### Earnings and Working Conditions

A national survey indicated that the average annual salary of trainees

employed as job analysts in private industry was about \$7,100 in early 1966; experienced job analysts averaged \$11,300; directors of personnel generally earned between \$10,000 and \$18,000 and some top personnel and industrial relations executives in very large corporations earned considerably more.

In the Federal Government, inexperienced graduates with bachelor's degrees started at \$5,331 a year in early 1967; those with exceptionally good academic records or master's degrees began at \$6,451; a few master's degree holders who ranked high in their respective classes received \$7,696 a year. Federal Government personnel workers with higher levels of administrative responsibility and several years of experience in the field were paid about \$13,000; some in charge of personnel for major departments of the Federal Government earned \$18,000 or more a year.

Employees in personnel offices generally work 35 to 40 hours a week. During a period of intensive recruitment or emergency, they may work much longer. As a rule, personnel workers are paid for holidays and vacations, and share in the same retirement plans and other employee benefits available to all professional employees in the organizations where they work.

### Where To Go for More Information

General information on personnel work as a career may be obtained by writing to:

American Society for Personnel Administration,  
52 East Bridge St., Berea, Ohio  
44017.

Information about government careers in personnel work may be obtained from:

Public Personnel Association,  
1313 East 60th St., Chicago, Ill.  
60637.

## PUBLIC RELATIONS WORKERS

(D.O.T. 165.068)

### Nature of Work

All organizations—both profit and nonprofit—want the public to view them in a favorable light. Public relations workers help their employers build and maintain such a public image by keeping themselves informed about the attitudes and opinions of customers, employees, and other groups important to the interests of their employers.

Public relations workers provide information about their employers' business to newspapers and magazines, radio and television, and other channels of communication. They plan the kind of publicity that they believe will be most effective, contact the people who may be interested in using it, and prepare and assemble the needed material. Many items in the daily papers, human interest stories in popular magazines, and pamphlets giving information about a company, the product it makes and job opportunities with it, have their start at public relations workers' desks. These workers also may play an important part in arranging speaking engagements for company officials, and sometimes write speeches for them to deliver. Often they participate in community affairs, serving as their employers' representatives during safety campaigns and other community projects. Showing a film at a school assembly, staging a beauty contest, calling a press conference, and planning a convention may all be part of a public relations worker's job.

Public relations workers tailor their programs to their employers' particular needs. In a business firm, the public relations worker is usually concerned with his employer's relationships with employees, government agencies, civic organizations, and other community groups.

Public relations staffs in large firms sometimes number 100 or more. Re-

sponsibility for developing overall plans and policies may be shared between a vice president or other top executive who is responsible for final decisions, and the director of a public relations department. In addition to the public relations department's writers and research workers, there may be specialists in different kinds of public relations work—in preparing material for publication in the daily press, for example, or in writing reports sent to stockholders.

Public relations workers who handle publicity for an individual or who are in charge of a limited public relations program for a university, fraternal organization, or small business firm may handle all aspects of the work. They make their own contacts with outsiders, do the necessary planning and research, prepare material for publication, and carry out other duties. Such public relations workers may be top-level officials or they may occupy positions farther down the management ladder. They may combine public relations duties with advertising or other managerial work.

### Where Employed

In 1967, more than 50,000 public relations workers were employed according to the limited data available. About one-fourth were women. In recent years, an increasing number of women have entered public relations work, particularly in department stores, hospitals, hotels, and restaurants.

The majority of public relations workers are employed by manufacturing firms, stores, public utilities, trade and professional associations, and labor unions. Others are in consulting firms which provide counsel and other kinds of public relations services to clients on a fee basis.

Employment in public relations work tends to be concentrated in big cities where press services and other communications facilities are readily available and where large corporations and trade, professional, and

other associations have their headquarters. More than half of the consulting firms are either in New York City or in Los Angeles, Chicago, and Washington, D.C.

### Training, Other Qualifications, and Advancement

A college education is generally regarded as the best preparation for public relations work; however, employers differ in the specific type of college background they require of applicants. Some prefer graduates with majors in English, journalism, or public relations; others prefer candidates with a background in science or some other field related to the firm's business activities. In 1966, seven colleges offered a bachelor's degree in public relations and six offered the master's degree. In addition, over 150 colleges offered at least one course in public relations.

Among the college subjects considered desirable as preparation for a career in public relations are journalism, economics and other social sciences, business administration, psychology, public speaking, literature and physical sciences. Extracurricular activities, which may provide students with some valuable experience, include writing or other work connected with school publications, participation in student government activities, and part-time or summer employment in selling, public relations, or related fields of work.

Among the personal qualifications usually considered important for work in this field are creativity, initiative, drive, the ability to express thoughts clearly and simply. Fresh ideas are so important to effective public relations work that some experts in this field spend all of their time providing ideas and planning programs but take no active part in carrying out the programs. In selecting new employees, many employers prefer people who have had some previous work experience, particularly in journalism or some related field.

Some companies—particularly those with large public relations programs have formal training programs for new employees. In other companies, new employees learn on the job by working under the guidance of experienced staff members. Beginners often start out maintaining files of material about the company and its activities, scanning newspapers and magazines for appropriate articles to clip, and doing the research needed to assemble information for speeches and pamphlets. After gaining experience, they may be given progressively more difficult assignments, such as writing press releases, speeches, and articles for publication. Promotion to supervisory and managerial positions may come as the worker demonstrates ability to handle more difficult and creative assignments. The most skilled public relations work—initiating and developing plans and maintaining the outside contacts which are so important in a successful program—is usually in the hands of the director of the department and his most experienced staff members. Some experienced public relations workers eventually open their own consulting firms as others move on to better positions with other employers.

### Employment Outlook

Employment in this field is expected to expand rapidly through the 1970's. In addition to the new jobs created as expanding business firms require the services of more public relations specialists, other openings will occur because of the need to replace workers who retire or leave the field for other reasons.

The demand for public relations workers is expected to grow through the 1970's as population increases and the general level of business activity rises. In recent years there has been an increase in the amount of funds spent on public relations, and many companies have newly organized public relations departments.

This development will continue in future years.

### **Earnings and Working Conditions**

Starting salaries for public relations workers averaged about \$5,500 a year in 1966, according to the limited data available. The highest starting salaries were paid chiefly to beginners who were employed by consulting firms in major cities and who were very well qualified from the standpoint of educational background and previous work experience. Many public relations workers with a few years of experience earned between \$8,000 and \$12,000 a year.

The salaries of experienced public relations workers are generally highest in large companies, where public

relations programs are likely to be more extensive than elsewhere. In 1966, directors of public relations employed by medium-size firms generally earned \$12,000 or more annually, and those employed by large corporations had salaries in the \$15,000 to \$25,000 range, according to the Public Relations Society of America. Some officials, such as vice presidents in charge of public relations, earned from \$25,000 to \$50,000 or more a year. Many consulting firms employ fairly large staffs of experienced public relations specialists and often pay salaries which are somewhat higher than the salaries paid public relations workers in other business organizations. In social welfare agencies, nonprofit organizations, and universities, salary levels tend to be somewhat lower.

The workweek for public relations workers is usually the same as for other officials in their organizations—35 to 40 hours. Irregular hours and overtime often may be necessary, however, to meet deadlines, prepare or deliver speeches, attend meetings and community functions, and make trips out of town. Sometimes, because of the nature of their regular assignments or because of special events, they may be on call on a round-the-clock basis causing the workweek to stretch to 6 or 7 days instead of the usual 5.

### **Where To Go for More Information**

The Information Center, Public Relations Society of America, Inc.  
845 Third Ave., New York, N.Y.  
10022.

other duties in meeting their religious responsibilities.

Young people considering a career as a clergyman should seek the counsel of a religious leader of their faith to aid them in evaluating their qualifications for the profession. Besides a desire to serve the spiritual needs of others and to lead them in religious activities, they 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, young people should know that clergymen are expected to be examples of high moral character.

The amount of income clergymen receive depends, to a great extent, on the size and financial status of the congregation they serve and usually is 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 a number of Jewish congregations provide their spiritual leaders with housing. Roman Catholic priests ordinarily live in the rectory of a parish church or are provided lodgings by the religious order to which they belong. Many clergymen receive allowances for transportation and other expenses necessary in their work. Clergymen often receive gifts or fees for officiating at special ceremonies such as weddings and funerals. In some cases, these gifts or fees are an important source of additional income; however, they are frequently donated to charity by the clergymen. Some churches establish a uniform fee for these services, which goes directly into the church treasury.

More detailed information on the clergy 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. Numerous other church-related occupations—those of the missionary, teacher, director of youth organizations, director of religious education, editor of religious publications, music director, church secretary, recreation leader, and many others—offer interesting and satisfying careers. In addition, opportunities to work in connection with religious activities are present in many other occupations. Clergymen or educational directors of local churches or synagogues can provide information on the church-related occupations and other areas offering opportunities for religious service.

## THE CLERGY

The choice of the ministry, priesthood, or rabbinate as one's lifework involves considerations that do not influence to the same degree the selection of a career in most other occupations. When young people decide to become clergymen, they do so primarily because of their religious faith and their desire to help others. Nevertheless, it is important for them to know as much as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel. They should understand also that the civic, social, and recreational activities of clergymen are often influenced, and sometimes restricted, by the customs and attitudes of their community.

The number of clergymen needed is broadly related to the size and geographic distribution of the Nation's inhabitants and their participation in organized religious groups. These factors affect the number of churches and synagogues that are established and, thus, the number of pulpits to be filled. A sharp rise in church and synagogue membership has occurred since 1940. About 125 million people were members of organized religious groups in 1967—representing nearly two-thirds of the total population, whereas in 1940, slightly less than half the population belonged to religious groups. In addition to those who serve congregations, many clergymen teach in seminaries and other educational institutions, serve as missionaries, and perform various

### PROTESTANT CLERGYMEN

(D.O.T. 120.108)

#### 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 many other ways. Protestant ministers may also write articles for publication and engage in interfaith, community, civic, educational, 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, ministers follow a traditional order of worship, whereas in others they adapt the services to 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 serving small congregations generally work on a close personal basis with their parishioners. Those serving large congregations usually have greater administrative responsibilities and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one associate or assistant or more who share specific aspects of the ministry, such as a Minister of Education who assists in educational programs for different age groups.

### Where Employed

In 1967, about 240,000 people were serving as ministers of churches, composing over 225 Protestant denominations or other groups. In addition, thousands of ordained clergymen were in other occupations—many closely related to the ministry. The greatest number of clergymen are affiliated with the four largest groups of churches—Baptist, Methodist, Lutheran, and Presbyterian—to which about 7 out of every 10 of nearly 70 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, about 80 denominations ordain women. In addition, in some denominations an increasing number of women who have not been ordained are serving as pastors' assistants. Also, in a growing number of denominations certain orders of women workers are referred to as deaconesses.

All cities and most towns have one Protestant church or more 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 congregations or more 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. An increasingly large number of denominations, however, 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.

Ninety of the theological institutions in the Nation in 1967 were 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 pre-seminary 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: Bibli-

cal, historical, theological, and practical. There is a trend toward adding more courses in psychology, pastoral counseling, sociology, religious education, administration, and other studies of a practical nature. 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 year or more of additional study. Scholarships and loans are available for students of theological institutions.

In general, each large denomination has its own school or schools of theology which reflect its particular interests and needs; however, many of these schools are open to students from various denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering 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 high moral and ethical standards, 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 begin their careers as pastors of small congregations or as assistant pastors in large churches. Protestant clergymen in many of the larger denominations—especially those groups which have a well-defined church organization—often are requested to serve in positions of great administrative and denominational responsibility.

## Outlook

The supply of well-qualified Protestant ministers probably will continue to be less than the demand through the 1970's, especially among those denominations where the extent of formal training requires many years of preparation for the ministry. Although the number of students graduating from theological schools has increased over the past 10 years, the gains have not been great enough to replace the thousands of ministers who retire, die, or leave the profession each year and at the same time to meet the needs of newly established congregations and to supply assistant ministers where needed.

Many congregations—mainly those in rural areas—did not have a full-time ordained minister in 1967. Some had to rely on the services of theological students or lay persons or share the services of a pastor with another congregation. Some large congregations were unable to fill openings for assistant ministers with specialized skills. In addition, ordained ministers were being sought for teaching positions; to serve in foreign missions, in relief work, and in religious educational activities; as chaplains in the Armed Forces; and in universities, hospitals, penitentiaries, and other institutions.

The total number of ministers needed by Protestant churches will probably increase 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 youth and family relations work, the campus ministry, and religious activities including chaplaincies in institutions and industry, also point toward a need for additional clergymen. Replacement of those who retire, die, or leave the ministry for other causes also will require an ever-increasing number of newly trained ministers. In addition, there is a growing demand for clergymen to serve as faculty members in

departments of religion in public and private universities.

## 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 on both the ministry and other church-related occupations are also available from many denominational offices. Information on admission requirements may be obtained directly from each theological school.

## RABBIS

(D.O.T. 120.108)

### Nature of Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct daily services and hold special services on the Sabbath and on holidays. Rabbis are customarily available at all times for counsel to members of their congregations, other followers of Judaism, and the community at large. Many of the rabbis' functions—preparing and delivering sermons, performing wedding ceremonies, visiting the sick, conducting funeral services, comforting the bereaved, helping the poor, supervising religious education programs, engaging in interfaith activities, assuming community responsibilities, and counseling individuals—are similar to those performed by clergymen of other faiths. Rabbis may also write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Rabbis serve congregations affiliated with 1 of the 3 branches of 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 follow the traditional form of worship—for example, in the wearing of head coverings or in the use of Hebrew as the language of prayer, or in the use of music. Because of these differences, the format of the worship service and therefore the ritual that the rabbis use may vary even among congregations belonging to the same branch of Judaism.

## Where Employed

More than 5,000 rabbis served about 5¾ million followers of the Jewish faith in this country in 1966. Most are Orthodox rabbis; the rest are about equally divided between the Conservative and Reform branches of Judaism. Most rabbis act as spiritual leaders of individual congregations; some serve as chaplains in the Armed Forces, in hospitals, and in other institutions; others teach in educational institutions or are employed in religious education work for such organizations as the Hillel Foundation; and still others are employed by Jewish social welfare agencies.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States which have sizable Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, and Massachusetts.

## Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete the prescribed course of study at a Jewish theological seminary.

Entrance and training requirements depend upon the branch of Judaism with which the seminary is associated. The Hebrew Union College—Jewish Institute of Religion is the only seminary that trains rabbis for the Reform branch of Judaism. The Jewish Theological Seminary of America is the only seminary that trains rabbis for the Conservative

branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as prior preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Although 5 years are normally required to complete the rabbinic course at the Reform seminary, exceptionally well-prepared students can shorten this period of study to a minimum of 3 years. The course at the Conservative seminary can be completed in 4 years if the student has a strong background in Jewish studies; otherwise, the course may take as long as 6 years.

About 15 seminaries train Orthodox rabbis. These schools have programs of various lengths, all leading to ordination. Two of the larger Orthodox seminaries require the completion of a 4-year college course to qualify for ordination. However, students who are not college graduates may spend a longer period at each of these seminaries and complete the requirements for the bachelor's degree at the same time they are pursuing the rabbinic course. Other Orthodox seminaries do not require a college degree to qualify for ordination; however, in most cases students qualifying for ordination have completed 4 years of college.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive grasp of all aspects of Jewish knowledge, Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. The Reform seminary places less emphasis on the study of Talmud and Rabbinic literature and offers a broad course of study that includes such subjects as human relations and community organization.

Some seminaries grant advanced academic degrees in such fields as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available to students.

Newly ordained rabbis usually begin as leaders of small congregations, as assistants to experienced rabbis, or

as chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

The choice of a career as a rabbi, of course, should be made on the basis of a fervent belief in the religious teachings and practices of Judaism and of a desire to serve the religious needs of others. In addition to having high moral and ethical values, the prospective rabbi should have good judgment and be able to write and speak effectively.

### Outlook

In 1967, the number of rabbis in this country was inadequate to meet the expanding needs of Jewish congregations and other organizations desiring their services. This situation is likely to persist through the 1970's. In recent years, many congregations—especially those located in States where there are relatively few persons of the Jewish faith—were unable to 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 also have been sought to lead the many new congregations which had been organized in and around New York, Chicago, Los Angeles, Philadelphia, Boston, and other cities with large Jewish populations.

The recent increases in Jewish religious affiliation and in the number of synagogues and temples seem likely to continue. Furthermore, an increasing demand for rabbis to work with social welfare and other organizations connected with the Jewish faith is anticipated.

Although the number of students graduating annually from the Jewish theological seminaries is expected to increase, there will probably not be enough new graduates to replace the rabbis who retire or die, and to fill the openings which will be created by the expanding work of the large congregations and by the formation of new congregations. Immigration, once an

important source of supply of rabbis, is no longer significant. In fact, graduates of American seminaries are now in demand for Jewish congregations in other countries.

### Where To Go for More Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Additional information on how to prepare for service in the rabbinate of a particular branch of Judaism, including school admission requirements, may be obtained from each theological school.

### ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

#### Nature of Work

Roman Catholic priests attend the spiritual, moral, and educational needs of the members of their church. Their duties include offering the Sacrifice of the Mass; hearing confessions; administering the Sacraments (including the sacrament of marriage); visiting and comforting the sick; 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 the work of the church continues.

Priests spend long hours performing services for the church and the community. Their day usually begins with morning meditation and Mass and may end with an evening visit to the local hospital or the hearing of confessions. In addition, each day priests spend time in prayer. Many of them serve on church committees or in civic organizations and assist in community projects. Various societies that 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 hold teaching and administrative posts in the Catholic seminaries, universities and colleges, and high schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas secular priests are primarily concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and in the foreign field.

### Where Employed

More than 59,000 priests served over 46 million Catholics in the United States in 1967. 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 regions, 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 on 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. In 1967, over 48,000 students, known as seminarians, were enrolled in more than 600 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 may enter the minor seminary where they complete their high school work before taking the 2 years of college level work. Courses include Christian doctrine, Latin, Greek, English, at least one other modern language, rhetoric and elocution, history, geography, bookkeeping, mathematics, and natural sciences.

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 major 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 univer-

sities 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 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, educational, and social needs of the rising number of Catholics in the Nation. Although the number of seminarians has increased steadily in recent years, the number of ordained priests is not sufficient to fill the needs of newly established parishes and expanding colleges and other Catholic institutions, and to replace priests who die. Although priests usually continue at their work longer than persons in other professions, 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, in religious radio, newspaper, and television work, labor-management mediation and in foreign posts, particularly in countries with a shortage of priests. 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 through the 1970's.

#### **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, or from the diocesan chancery office.

## CONSERVATION OCCUPATIONS

Forests, rangelands, wildlife, and water are part of our country's great wealth of natural resources. Conservationists protect, develop, and manage natural resources to assure that they are not needlessly exhausted, destroyed, or damaged, and that future needs for the resources will be met.

Specialized training is generally required to work in conservation occupations. Many positions can be filled only by those having at least a bachelor's degree. For other positions, the desired training may be obtained on the job.

This chapter includes descriptions of three conservation occupations—forester, forestry aid, and range manager. Soil conservationist, a related occupation, is discussed elsewhere in this *Handbook*.

### FORESTERS

(D.O.T. 040.081)

#### Nature of Work

Forests are one of America's greatest natural resources, covering more than one-third of the land area of the country. Foresters manage, develop, and protect these valuable lands and their resources—timber, water, wildlife, forage, and recreation areas. They estimate the amount and value of these resources. They plan and

supervise the harvesting and cutting of trees, purchase and sale of trees and timber, and reforestation activities (renewing the forest cover by seeding or planting). Foresters also safeguard forests from fire, destructive animals and insects, and diseases. Other responsibilities of foresters include wildlife protection and watershed management, and the management of camps, parks, and grazing land.

Foresters usually specialize in one area of work, such as timber management, fire control, forest economics, outdoor recreation, watershed management, wildlife management, or range management. Some of these specialized activities are becoming recognized as distinct professions. The profession of range managers, for example, is discussed in a separate statement in this chapter. Foresters may also engage in research activi-

ties, extension work (providing forestry information to farmers, logging companies, and the public), forest marketing, and college and university teaching.

### Where Employed

An estimated 23,000 persons were employed as foresters in the United States in early 1967. About 8,000 were employed by the Federal Government, mainly in the Forest Service of the Department of Agriculture. Other Federal agencies employing significant numbers of foresters were the Departments of the Interior and Defense. State governments employed several thousand foresters, and a few hundred were employed by local governments.

About 8,000 foresters were employed in private industry in early



Forester locates his position on aerial photograph.

1967, mainly by pulp and paper, lumber, logging, and milling companies. Some foresters were managers of their own land. Others were in business for themselves as consultants, or were employed by consulting firms. Colleges and universities employed more than 1,000 foresters.

### **Training, Other Qualifications, and Advancement**

A bachelor's degree with a major in forestry is the minimum educational requirement for young persons seeking professional careers in forestry. An advanced degree is generally required for teaching and research positions.

Training in forestry leading to a bachelor's or higher degree was offered in 1966 by 47 colleges and universities. 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 (primarily against 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, processing, and marketing of the forest crop and other forest resources). The curriculums also include related courses in the management of recreational lands, watershed management, and wildlife management, as well as courses in mathematics, science, engineering, economics, and the humanities. Most colleges require that students spend one summer in a field camp operated by the college. Forestry students are also encouraged to work other summers in jobs that will give them firsthand experience in forest or conservation work.

Beginning positions for forestry graduates often involve work in a broad range of relatively routine forestry activities under the supervision

of experienced foresters. As they gain experience, foresters may advance to increasingly responsible positions in management of forest lands or related research activities.

Qualifications for success in forestry include an enthusiasm for outdoor work and the ability to meet and deal effectively with people. Many jobs also require physical stamina and a willingness to work in remote areas.

### **Employment Outlook**

Employment opportunities for forestry graduates are expected to be good through the 1970's. Among the major factors underlying this anticipated demand are the country's growing population and rising living standards, which will tend to increase the demand for forest products, and the use of forests for recreation areas. Forestry and related employment may also be favorably influenced by the growing awareness of the need to conserve and replenish our forest resources.

Private owners of timberland are expected to employ increasing numbers of foresters to realize the higher profitability of improved forestry and logging practices. The forest products industries also will require additional foresters to apply new techniques for utilizing the entire forest crop, to develop methods of growing superior stands of trees over a shorter period of time, and to do research in genetics and fertilization. In addition, competition from metal, plastics, and other materials is expected to stimulate further research to develop new and improved wood products.

The Federal Government is likely to offer increasing employment opportunities for foresters in the years ahead, mainly in the Forest Service of the Department of Agriculture. Among the factors expected to contribute to this expansion are the demands for the use of national forest resources, the trend toward more scientific management of these lands, and expanding research and conservation programs in areas such as out-

door recreation, watershed management, wildlife protection, and range management.

State government agencies should also offer additional employment opportunities for foresters. Forest fire control, protection against insects and diseases, provision of technical assistance to owners of private forest lands, and other Federal-State cooperative programs are usually channeled through State forestry organizations. Growing demands for recreation facilities in forest lands are likely to result in expansion of State parks and other recreational areas.

College teaching and research in such areas as forest genetics, forest disease and insect control, forest products utilization, and fire behavior and control are other avenues of favorable employment opportunity for foresters, but primarily for those with graduate degrees.

In addition to new positions created by the rising demand for foresters, a few hundred openings will arise each year due to retirements, deaths, and transfers out of the profession.

Opportunities for women in outdoor forestry is somewhat limited, largely because of the strenuous physical requirements of much of the work. The few women presently employed in forestry are engaged chiefly in research, administration, and educational work; future opportunities for women are also likely to be primarily in these fields.

### **Earnings and Working Conditions**

In the Federal Government in 1967, beginning foresters with the bachelor's degree could start at either \$5,331 or \$6,451 a year, depending on their academic record. Those with 1 or 2 years of graduate work could begin at \$6,451 or \$7,696; those with the Ph. D. degree, at \$9,221 or \$10,927. District rangers employed by the Federal Government in 1966 generally earned between \$9,000 and \$12,000 a year. Foresters in top level positions earned considerably more.

Beginning salaries of foresters employed by State governments vary widely; but, with a few exceptions, they tend to be lower than Federal salaries. Entrance salaries in private industry, according to limited data, are fairly comparable to Federal salary levels.

College and university average (median) salary was among the highest in the forestry profession in 1964, approximately \$11,000 a year, according to a survey conducted in 1965. However, the salaries of forestry teachers at a particular level of responsibility were generally the same as those paid other faculty members. (See statement on College and University Teachers.) Foresters in educational institutions sometimes supplement their regular salaries with income from part-time consulting, lecturing, and writing books and articles.

As part of his regular duties, the forester—particularly in beginning positions—spends considerable time outdoors under all kinds of weather conditions. Many foresters put in extra hours in emergency duty, such as firefighting.



Forestry aid wraps pine tree to keep squirrels from disturbing cones.

### Where To Go for More Information

Society of American Foresters,  
1010 16th St. NW., Washington,  
D.C. 20036.

Forest Service, U.S. Department of  
Agriculture,  
Washington, D.C. 20250.

American Forest Products Industries,  
Inc.,  
1835 K St. NW., Washington, D.C.  
20006.

American Forestry Association,  
919 17th St. NW., Washington, D.C.  
20006.

### FORESTRY AIDS

(D.O.T. 441.384)

#### Nature of Work

Forestry aids, called *forestry technicians* at higher career levels, assist foresters in managing and caring for

forest lands and their resources. (See statement on Foresters earlier in this chapter.) Their duties include scaling logs, marking trees, and collecting and recording such data as tree heights, diameters, and mortality. On simple watershed improvement projects, aids install, maintain, and collect records from rain gauges, stream-flow recorders, and soil moisture measuring instruments. They may serve as rodmen, chainmen, or level instrumentmen on road survey crews.

Forestry technicians have more responsible and difficult duties, such as supervising on-the-ground operations in timber sales, supervising recreation-area use, and performing laboratory research activities that require the use of practical skills and experience. Forestry technicians also supervise survey crews engaged in road building projects that make timber accessible for harvesting.

Forestry aids are often engaged in all phases of fire prevention and control. They instruct persons using the forest in fire precautions and prevention. If a fire does occur, they may lead firefighting crews. After the fire has been suppressed, they take inventory of the burned out area and plant new trees and shrubs.

### Where Employed

An estimated 12,000 persons were employed as forestry aids in early 1967. About 5,000 were employed by the Federal Government, mainly by the Forest Service of the U.S. Department of Agriculture. Approximately 2,000 were working for State governments. About 5,000 were employed in private industry, primarily by lumber, logging, and paper milling companies. Forestry aids also worked in tree nurseries and in forestation projects of mining, railroad, and oil companies.

Many forestry aids are employed in the heavily forested States of Washington, California, Oregon, Idaho, Utah, and Montana.

### Training, Other Qualifications, and Advancement

Young persons qualify for beginning positions as forestry aids either by completing a specialized 1- or 2-year post-secondary-school curriculum or through work experience. Curriculums designed to train forestry aids are offered in technical institutes, junior colleges, and ranger schools (schools that specialize in training forestry aids).

Among the specialized courses provided for aid training are forest mensuration (measurement of the number and size of trees in the forest), forest protection, dendrology (identification of trees and shrubs), wood utilization, and silviculture (methods of growing and improving forest crops). In addition, the student takes courses, such as drafting, surveying, report writing, mathematics, and first

aid and spends time in a forest or camp operated by the school, where he obtains experience in forestry work.

Persons who have not had post-secondary-school training must usually have had experience in forest work, such as felling or planting trees and fighting fires, to qualify for beginning forestry aid jobs. In the Federal Government, the minimum experience requirement is two seasons of related work. Those who had some technical experience, such as estimating timber resources, may qualify for more responsible positions.

Qualifications considered essential for success in this field are an enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks without direct supervision. The forestry aid also should be able to work well with others, for much of his work is with survey crews or involves contact with users of the forestlands. Many jobs also require a willingness to work in remote areas.

### Employment Outlook

Employment opportunities for forestry aids are expected to increase rapidly through the 1970's. Prospects will be especially good for those with post-high-school training in a forestry curriculum. As the employment of foresters continues to grow, increasing numbers of forestry aids will be needed to assist them. Also, it is expected that forestry aids will assume some of the more routine jobs now being done by foresters.

Private industry is expected to provide many additional employment opportunities for forestry aids. Forest products industries are becoming increasingly aware of the profitability of employing technical persons knowledgeable in the practical application of scientific forest practices.

The Federal Government is also likely to offer increasing employment opportunities through the 1970's, mainly in the Forest Service of the Department of Agriculture. Similarly, State governments will probably

increase their employment of forestry aids. Growth in Government employment will stem from factors such as increasing demand for recreational facilities, the trend toward more scientific management of forest land and water supplies, and an increasing amount of timber cutting on Federal forest land.

### Earnings and Working Conditions

Annual earnings of forestry aids range from about \$4,000 to over \$7,500 a year; those with high earnings usually have many years of experience. In the Federal Government, beginning forestry aids and technicians earned between \$3,925 and \$5,331 a year in 1966, depending on the applicant's education and experience. Beginning salaries in private industry were similar, according to limited data.

As part of their regular duties, forestry aids must spend considerable time outdoors during all weather conditions. In emergencies, such as firefighting and flood control, forestry aids work many extra hours. In addition to those employed full time, many forestry aids are hired on a seasonal basis, working 3 to 6 months a year. Climatic conditions in some areas limit year-round field work and jobs such as firefighting are seasonal in nature.

### Where To Go for More Information

Forest Service, U.S. Department of Agriculture,  
Washington, D.C. 20250.

### RANGE MANAGERS

(D.O.T. 040.081)

#### Nature of Work

Rangelands cover more than 700 million acres in the United States, mostly in the Western and Southern States. Range managers, also called

*range conservationists* or *range scientists*, are responsible for the management, development, and protection of these rangelands and their resources. They establish systems and plans for grazing that will yield a high production of livestock while preserving conditions of soil and vegetation necessary to meet other land-use requirements—wildlife grazing, recreation, growing timber, and watersheds. Range managers evaluate forage resources; decide on the number and appropriate type of livestock to be grazed and the best season for grazing; restore deteriorated rangelands through seeding or plant control; and determine other range conservation and development needs. Range fire protection, pest control, and grazing trespass control are also important areas of work. In addition, multiple use of rangelands often extends the manager's work into such closely related fields as wildlife and watershed management, land classification, forest management, and recreation.

The range manager's activities may include research in range maintenance and improvement, report writing, teaching, extension work (providing information about range management to holders of privately owned grazing lands), or performing technical assignments in foreign countries.

### Where Employed

In early 1967, an estimated 3,500 professional range managers were employed in the United States. Approximately 1,500 were employed by Federal Government agencies, primarily in the Forest Service and the Soil Conservation Service of the Department of Agriculture and in the Bureau of Land Management of the Department of the Interior. State governments also employed significant numbers of range managers.

In private industry, many range managers are employed by privately owned range livestock ranches. Some



Range managers record condition of range vegetation.

are in business for themselves as consultants, or are employed by consulting firms. Others are employed by manufacturing, sales, and service enterprises, and by banks and real estate firms which need rangeland appraisals. Colleges and universities also employ range managers in teaching and research positions.

### Training, Other Qualifications, and Advancement

The bachelor's degree with a major in range management or range conservation is the usual requirement for persons seeking employment as range managers in the Federal Govern-

ment. A bachelor's degree in a closely related subject-matter field, such as agronomy, animal husbandry, botany, forestry, soil conservation, or wildlife management, with courses in range management and range conservation, is also accepted as adequate preparation. Graduate degrees are generally required for teaching and research work.

Training leading to a bachelor's degree with a major in range management was offered in 1966 by 18 colleges and universities, mainly in Western and Southwestern States. Most of these schools also grant the master's degree, and a few award the doctorate.

The essential courses for a degree in range management are botany, plant ecology, and plant physiology; zoology; animal husbandry; soils; chemistry; mathematics; and specialized courses in range management, such as identification and characteristics of range plants, range improvement, and range sampling and inventory techniques. Desirable elective courses include economics, statistical methods, physics, geology, watershed management, wildlife management, surveying, and forage crops.

Federal Government agencies—primarily the Forest Service and the Bureau of Land Management—hire many college juniors and seniors for summer jobs in range management. This experience helps students qualify for permanent positions as range managers when they complete college.

Because most range managers must meet and deal with other people, individually or in groups, they should be able to communicate their ideas effectively, both in writing and speaking. Many jobs require the stamina to perform vigorous physical activity and a willingness to work in arid and sparsely populated areas.

### Employment Outlook

Employment opportunities for graduates with degrees in range management are expected to be good through the 1970's. The demand will be especially good for well-qualified persons with advanced degrees to fill research and teaching positions.

Opportunities will probably be best in Federal agencies. Favorable opportunities are also expected in private industry, since range livestock producers and private timber operators are hiring increasing numbers of range managers to improve their range holdings. Some openings are expected for range managers to give technical assistance to developing countries of the Middle East, Africa, and South America.

Among the major factors underlying the anticipated growth in de-

mand for range managers are population growth, increasing per capita consumption of animal products, and the growing use of rangelands for hunting and other recreational activities. Many openings are expected because of the more intensive management of range resources with increasing emphasis on multiple uses of rangelands. Range managers will also be needed to help rehabilitate deteriorated rangelands, improve semiarid lands, and deal with watershed problems.

Opportunities for women in this profession are limited because of the rigorous work generally required and the remote locations of employment. However, a few women, usually with training in botany, work on classification and identification of range plants.

### **Earnings and Working Conditions**

In the Federal Government in early 1967, starting salaries for range managers with the bachelor's degree were either \$5,331 or \$6,451 a year, depending upon their college record. Beginning salaries for those with 1 or 2 years of graduate work were \$6,451 or \$7,696; and for those with the Ph. D., \$9,221 or \$10,927.

Starting salaries for range managers employed by State governments and private industry in 1967 were about the same as those paid by the Federal Government. In colleges and universities, starting salaries were generally the same as those paid other faculty members. (See statement on College and University Teachers.) Range managers in educational institutions sometimes augment their regular sal-

aries with income from part-time consulting and lecturing and from writing books and articles.

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

### **Where To Go for More Information**

American Society of Range Management,  
Box 13302, Portland, Oreg. 97213.

Bureau of Land Management,  
U.S. Department of Interior,  
Washington, D.C. 20240.

Forest Service,  
U.S. Department of Agriculture,  
Washington, D.C. 20250.

Soil Conservation Service,  
U.S. Department of Agriculture,  
Washington, D.C. 20250.

## COUNSELING

The primary objectives of professional counseling are to help persons understand themselves and their opportunities better, so that they can make and carry out decisions and plans that hold potential for a more satisfying and productive life. Whatever the area of counseling—personal, educational, or vocational—counselors need a concern for individuals combined with a capacity for objectivity; and a belief in the worthwhileness and uniqueness of each individual, in his right to make and accept responsibility for his own decisions, and in his potential for development.

This chapter deals in detail with three generally recognized specialties in the field: School counseling, rehabilitation counseling, and vocational or employment counseling.

*School Counselors* are the largest counseling group. They are concerned with the personal and social development of pupils and the planning and achievement of their educational and vocational goals.

*Rehabilitation Counselors* work with persons who are physically, mentally, or socially handicapped. Their counseling is vocationally oriented but involves personal counseling as well.

*Vocational Counselors* are concerned primarily with career planning and job adjustment. They may work with the young, the old, the able-bodied, and the disabled.

Some people who are identified

with other professional occupations also provide counseling services. The occupation most closely related to counselor is counseling psychologist. Many social workers also provide counseling services. These two occupations as well as others in which workers do some counseling but whose primary work is in teaching, health, law, religion, or other fields are described elsewhere in the *Handbook*. For information on counseling services provided by college and university staff members and by personnel workers in government and industry, see the statements on College Placement Officers and Personnel Workers.

### SCHOOL COUNSELORS

(D.O.T. 045.108)

#### Nature of Work

The personal and social development of students, the prevention or correction of problems that may interfere with their success, and their educational and vocational decisions are the concern of school counselors. In carrying out their responsibilities, counselors work with students individually and in groups, with their parents, and with teachers and other school personnel.

Counselors in secondary schools obtain information relevant to educational and vocational planning from student interviews, school and other records, and tests that assist in estimating a student's chances of success in a given occupation. The counselor may administer the tests. The counselor helps the student analyze and interpret the data and develops with him, and sometimes with his parents, a course of study and an educational plan fitting his abilities, interests, and vocational opportunities.

In their work, counselors may provide occupational information, including description of the work, training requirements, earnings, and out-

look. They maintain files or libraries of occupational literature for students and parents to use. They also arrange trips to factories and business firms and show vocational films. Many counselors conduct "career day" programs. School counselors also provide information and reference materials on various sources of post-high school education and training, including 2- and 4-year colleges; trade, technical and business schools; apprenticeship programs, programs under the Manpower Development and Training Act of 1962; and other training programs.

Counselors in secondary schools also may help students find part-time work while in school to enable them to stay in school or as part of their vocational preparation. They may also assist students in locating full-time employment after leaving school or may refer them to community employment services. Some counselors conduct followup studies of recent graduates and dropouts, cooperate in surveys of local job opportunities, and conduct or cooperate in research concerning the effectiveness of the educational and guidance programs.

Many secondary school counselors help students individually with personal and social problems that are common to adolescence. They may lead discussion groups on various topics related to student interests and problems.

The elementary school counselor is an emerging specialization. These counselors assist children to make maximum use of their abilities through early identification of their intellectual, emotional, social, and physical characteristics, and diagnosis of learning difficulties.

The methods used in counseling elementary school children necessarily differ in many respects from those used with older students. Classroom observation and play activity are among the techniques used with children in the lower grades. Elementary school counselors spend much of their time consulting with



parents and teachers. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, may teach classes in occupational information, social studies, or other subjects in addition to counseling. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

**Where Employed**

Approximately 45,000 persons performed some counseling functions in the public secondary schools during the 1965-66 school year, according to the U.S. Office of Education. More than 25,000 persons were full-time counselors. Counseling services in the elementary schools are being steadily expanded, but the number of trained counselors at this level is still small.

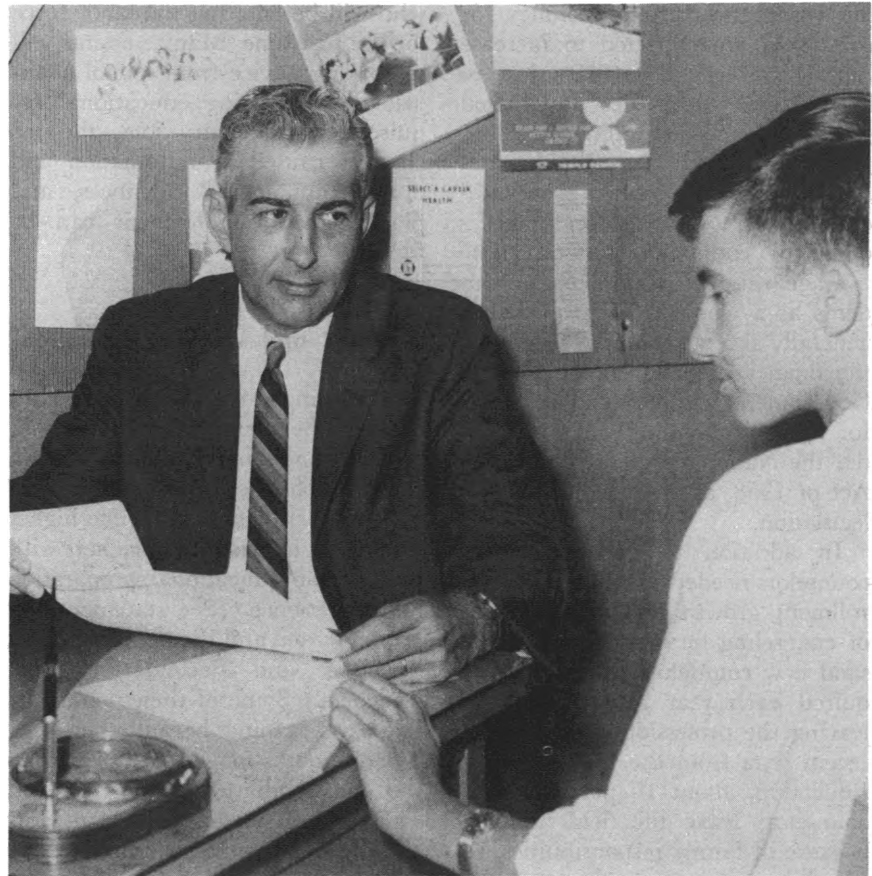
The majority of counselors are in large schools. An increasing number of school districts, however, are providing guidance services to their small schools by assigning several schools to a counselor.

About one-half of all high school counselors are women.

**Training, Other Qualifications, and Advancement**

Most States require counselors to have both a counseling and a teaching certificate. (See statement on Elementary and Secondary School Teachers for teaching certificate requirements.) A counseling certificate requires graduate level work and usually from 1 to 5 years of teaching experience. A person planning to counsel should obtain the specific requirements of the State in which he plans to work since requirements vary considerably among the States and are changing rapidly.

Undergraduate college students interested in becoming school coun-



High school counselor and student discuss postgraduation plans.

sels usually enroll in the regular program of teacher education, preferably taking additional courses in psychology and sociology. After graduating from college, they may acquire the teaching or other experience required either before or while studying for their advanced degrees. In some States, teachers who have completed part of the courses required for the master's degree are eligible for provisional certification and may counsel under supervision while taking additional courses. The subject areas of the required graduate level courses usually include individual appraisal, vocational development and informational services, counseling theory, statistics and research, group procedures, professional relations and ethics, and program development and management. Supervised field experience or internship is provided

in an increasing number of training programs. Counselor education programs at the graduate level are available in about 350 colleges and universities, most frequently in the departments of education or psychology. To obtain a master's degree, a student must complete 1 to 2 years of graduate study. School counselors may advance to counselor supervisors or directors of pupil personnel services.

**Employment Outlook**

Employment opportunities for well-trained school counselors are expected to be excellent through the 1970's. In early 1967, the supply of qualified counselors was inadequate to meet the existing demand, and this imbalance is expected to persist in

**REHABILITATION COUNSELORS**

(D.O.T. 045.108)

**Nature of Work**

Helping handicapped persons make a satisfactory occupational adjustment is the primary responsibility of the rehabilitation counselor. The counselor interviews handicapped persons to obtain necessary information about their abilities, interests, and limitations. Information developed in the interviews is used with other medical, psychological, and social data to help the handicapped person evaluate himself in relation to the kind of work that is suitable to his physical and mental capacity, interests, and talents. A plan of rehabilitation may then be worked out jointly by the counselor, the handicapped person, and those providing medical treatment, occupational training, and other special services. The counselor holds regular interviews with the disabled person to discuss the program, check on the progress made, and help resolve problems. When the individual is ready for employment, the counselor assists in finding a suitable job and often makes followup visits to be sure that the placement is satisfactory.

An increasing number of counselors specialize in a particular area of rehabilitation; for example, some work almost exclusively with the blind, some with alcoholics, and others with the mentally ill or retarded. Additional specialties are expected to develop as services for other types of difficulties are included in rehabilitation programs.

The time spent in the direct counseling of each individual varies with the person and the nature of his disability as well as with the counselor's workload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced or specialized counselors working with the severely handi-

the years ahead. Job openings for counselors are expected to increase rapidly through the 1970's just to keep pace with the anticipated growth in school enrollments. Thus, a substantial increase in the demand for counselors is expected even without allowing for any further strengthening of counseling services. The average ratio of counselors to students as a whole is still well below generally accepted standards, despite the financial aid which the Federal Government has provided to States for school counseling programs under the National Defense Education Act of 1958, as amended and other legislation.

In addition to the number of counselors needed to take care of enrollment growth and strengthening of counseling services, several thousand new counselors will also be required each year to replace those leaving the profession. According to recent data from the U.S. Office of Education, about 10 percent of all counselors leave the field annually because of family responsibilities, retirement, promotion to administrative jobs, or for other reasons.

Among the factors affecting the employment growth of school counselors is the increasing recognition of counseling as an essential educational service for all pupils—the average, the gifted, the slow, and the handicapped. Moreover, recent Federal legislation has extended support of school counseling services to elementary schools, technical schools, and junior colleges.

Also contributing to the increased demand for counseling services is the growing public awareness of the value of guidance services in helping students with personal and social problems which, in turn, may help reduce the number of school dropouts. The employment growth of counselors also will be influenced by the great number of high school students planning to go to college when admission requirements are being tightened and the large number of young people

who will be entering the labor force for the first time. Many students will be seeking advice from school counselors about rising educational requirements for entry jobs, the job changes caused by automation and other technological advances, and places where employment can be found.

**Earnings and Working Conditions**

According to the U.S. Office of Education, the average annual salary of school counselors was about \$8,000 in the 1965-66 school year. Many school counselors had annual earnings higher than those of classroom teachers with comparable educational preparation and experience. (See statements on Kindergarten and Elementary School Teachers and Secondary School Teachers.) Some of these counselors had extra earnings because they work 1 or 2 months longer each year than the classroom teachers. However, some school systems paid counselors an additional amount unrelated to the numbers of months worked.

In most school systems, counselors receive regular salary increments as their counseling experience increases and as they obtain additional education. Some counselors supplement their income by part-time consulting or other work with private or public counseling centers, government agencies, or private industry.

**Where To Go for More Information**

Information on colleges and universities offering training in guidance and counseling, as well as on the certification requirements of each State, may be obtained from the State department of education at the State capital.

Additional information on this field of work may be obtained from:

American School Counselor Association,  
1605 New Hampshire Ave. NW.,  
Washington, D.C. 20009.

capped may handle relatively few cases at a time. In addition to working with the handicapped person, the counselor must also maintain close contact with other professional people working with handicapped persons, members of their families, other agencies and civic groups, and private employers who hire the handicapped. The counselor is often responsible for related activities, such as employer education and community publicity for the rehabilitation program.

### Where Employed

About 6,700 rehabilitation counselors were employed in early 1967, approximately four-fifths were full-time counselors. About three-fourths of all rehabilitation counselors were employed in State and local rehabilitation agencies financed cooperatively with Federal and State funds. The remainder were employed by hospitals, labor unions, insurance companies, special schools, rehabilitation centers, sheltered workshops, and other public and private agencies that conducted rehabilitation programs and provided job placement services for the disabled. In addition, nearly 350 counseling psychologists in the Veterans Administration provided rehabilitation counseling.

An estimated 20 percent of all rehabilitation counselors are women.

### Training, Other Qualifications, and Advancement

A general educational requirement for entry into this occupation is graduation from a college or university with course credits in counseling, psychology, and related fields. At present, however, uniform requirements have not been established. Most employers prefer to hire people who have a master's degree in vocational or rehabilitation counseling or in a related discipline such as psychology, education, or social work; a few require a doctorate in counseling psychology. Employers are placing



increasing emphasis on the master's degree as the minimum educational standard for the profession. Work experience in related fields, such as vocational counseling and placement, social work, psychology, education, and other types of counseling, is also given considerable weight by some employers, especially when considering applicants who have only the bachelor's degree.

Two years usually are required to complete the master's degree in the fields of study preferred for rehabilitation counseling. The curriculum for the master's degree may include a

basic foundation in psychology and courses in: Medical aspects of rehabilitation, cultural and psycho-social aspects of disability, survey of therapeutic care and rehabilitation, legislative aspects of rehabilitation, counseling theories and techniques, occupational and educational information, community resources, placement and follow-up, and tests and measurements.

To earn the doctorate in rehabilitation counseling or in counseling psychology may require a total of 4 to 6 years of graduate study. Intensive training in psychology, other social

sciences, and the biological sciences as well as research methodology is required for the doctorate.

In the 1966-67 school year, 56 colleges and universities offered financial assistance to a limited number of graduate students specializing in rehabilitation counseling through training grants provided by the U.S. Department of Health, Education, and Welfare, Vocational Rehabilitation Administration. In these graduate programs an internship (supervised work in a rehabilitation setting) is required.

In approximately three-fourths of the State Rehabilitation Agencies, applicants are required to comply with State civil service and merit system rules. In most cases these regulations require the applicants to take a written competitive examination, which is sometimes supplemented by an individual interview and evaluation by a board of examiners. A few States require counselors to be residents of the State in which they work.

Counselors who have limited experience usually are assigned the least difficult cases; experienced and highly trained counselors are assigned persons with extreme or multiple disabilities that represent difficult rehabilitation problems. After obtaining considerable experience, rehabilitation counselors may be advanced to supervisory positions or to top administrative jobs.

Among the personal qualifications needed for success in this field are an understanding of human behavior, patience, and a capacity for working with people in solving their problems.

### Employment Outlook

The outlook for well-qualified rehabilitation counselors is expected to remain excellent through the 1970's. Persons with graduate work in rehabilitation counseling or in related fields will have the best opportunities for employment. Opportunities will be available also for persons with a bachelor's degree and related work experience.

The supply of qualified rehabilitation counselors was inadequate to meet the counseling needs of the mentally and physically handicapped in early 1967. The Vocational Rehabilitation Administration estimates that at least 2,000 new counselors will be needed annually through the 1970's to staff new and expanding programs and to replace counselors who leave the profession. This annual demand exceeds considerably the number presently being trained at graduate levels and entering the field. Over the next few years, the supply of rehabilitation counselors will be augmented to some extent by people from related fields, but the most closely related disciplines (psychology, social work, and education) are those in which the demand for qualified workers with graduate degrees is also expected to exceed the supply for several years to come.

Among the factors contributing substantially to the long-run demand for the services of rehabilitation counselors will be population growth, with related increases in the number of handicapped to be served; the extension of vocational rehabilitation to greater numbers of more severely disabled persons; increasing support for social welfare in general; and the growing awareness that expenditures for rehabilitation are often returned as savings on the appropriations for custodial care or health and social welfare programs.

### Earnings and Working Conditions

According to the U.S. Department of Health, Education, and Welfare, the beginning salary of rehabilitation counselors employed in State agencies in mid-1966 generally ranged from \$5,500 to \$7,500 a year. Counselors with a doctorate in psychology working with the disabled in the Veterans Administration were hired in early 1967 at annual salaries ranging generally from \$11,111 to \$13,321, depending on the applicant's experience and other qualifications.

Counselors may spend only part of their time counseling in their offices, and the remainder in the field working with prospective employers, training agencies, and the disabled person's family. The ability to drive a car is often necessary for field work.

Rehabilitation counselors generally work a 40-hour week or less with little overtime work required; however, they often attend community and civic meetings in the evenings. They are usually covered by sick and annual leave benefits, and pension and health plans.

### Where To Go for More Information

Additional information on rehabilitation counseling as a career may be obtained from:

- American Psychological Association, Inc.,  
1200 17th St. NW., Washington, D.C. 20036.
- American Rehabilitation Counseling Association,  
1605 New Hampshire Ave. NW.,  
Washington, D.C. 20009.
- National Rehabilitation Counseling Association,  
1522 K St. NW., Washington, D.C. 20005.

A list of colleges and universities that have received grants to provide rehabilitation traineeships on a graduate level is available from:

- U.S. Department of Health, Education, and Welfare,  
Vocational Rehabilitation Administration, Washington, D.C. 20201.

## VOCATIONAL COUNSELORS

(D.O.T. 045.108)

### Nature of Work

Vocational counselors (including employment counselors) help people develop and accept an adequate career goal that will use the individual's potential and bring personal satisfaction. They assist clients by planning with them on how to prepare for, enter, and progress in their

work. The extent of the counseling assistance available, however, differs among agencies.

Counselors interview the person seeking counsel to obtain vocationally significant information about his personal traits, interests, training, work experience, and work attitudes. They may assist the individual in filling out questionnaires concerning his personal history and background, which are then reviewed together. Additional data on the person's general intelligence, aptitudes and abilities, physical capacities, knowledge, skills, interests, and values are also obtained from tests and personal inventories which may be administered or recorded by the counselor or a specialist in testing. Further information may be assembled by the counselor or by the client from sources such as former employers, schools, and health or other agencies.

In subsequent interviews, counselors assist the applicant in evaluating and understanding his own work potential and provide him the information he needs in making plans appropriate to his talents and interests. Job requirements and employment opportunities or training programs are discussed. An employment plan is developed jointly by the counselor and his client, and a training or work program may be developed. In some agencies a vocational plan may be worked out in a staff conference—which may be attended by supervisors, the psychologist, the testing specialist, and a job market or occupational analyst.

In many cases the vocational or employment counselor will refer the client to another agency for physical restoration, psychological, or other services before, or concurrent with, counseling. The vocational counselor must be familiar with the services available in the community and be able to recognize what services might be beneficial to a particular client.

Counselors may help the client by suggesting feasible employment sources and appropriate ways of applying for work. In instances where the client needs further support and

assistance, the counselor may contact employers, although clients seeking employment are usually sent to placement interviewers following counseling. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed. The expanding responsibility of public employment counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. It also has led to group counseling and the stationing of counselors in neighborhood and community centers.

### Where Employed

In early 1966, the largest number of vocational counselors—about 2,800 full time and nearly 1,500 part time—were employed in State employment service offices, located in every large city and in many smaller towns. The next largest number—probably about 1,500—worked for various private or community agencies offering vocational counseling, primarily in the

larger cities. In addition, some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. The Federal Government employed a limited number of vocational counselors, chiefly in the Bureau of Indian Affairs and the Veterans Administration. Some people trained in vocational counseling are engaged in research or graduate teaching in the vocational guidance field. About half of all vocational counselors are women.

### Training, Other Qualifications, and Advancement

The generally accepted minimum educational requirement for employment counselors in State employment service offices is a bachelor's degree, preferably with a major in one of the social sciences, plus 15 semester hours in counseling and related courses. An increasing number of States are adopting a three-level counselor classification system which includes a *counselor intern* or trainee, requiring a bachelor's degree with 15 hours of undergraduate or graduate



Vocational counselor discusses possible jobs with client.

work in counseling related courses; a *counselor* requiring a master's degree or 30 graduate hours in counselor related courses; and a *master counselor* requiring a master's degree and 3 years of experience, 1 of which should be in employment service counseling.

Minimum entrance requirements are not standardized among private and community agencies, but most of them prefer, and many require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, education, or public administration. Most private agencies prefer to have at least one staff member with a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usually emphasize experience in closely related work such as rehabilitation counseling, employment interviewing, school or college counseling, or teaching.

The public employment service offices in each State provide in-service training programs for their new counselors or trainees; their experienced counselors frequently are given additional training at colleges and universities, often leading to a master's degree in counseling and guidance. Private and community agencies also often provide in-service training opportunities.

The professional educational curriculum for employment counselors generally includes, at the undergraduate level, a basic foundation in psychology with some emphasis on sociology. At the graduate level, requirements usually include courses in techniques of appraisal and counseling for vocational adjustment, group guidance methods, placement, counseling followup techniques, psychological tests in vocational counseling, educational psychology, psychology of occupations, industrial psychology, job analysis and theories of occupational choice, administration of guidance services, and some course work in research methods and statistics.

Counselor education programs at the graduate level are available in about 350 colleges and universities,

most frequently in the departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study. All States require counselors in their public employment offices to meet State civil service or merit system requirements that include certain minimum educational and experience standards. They also require a written or oral examination, or both.

Counselors who are well qualified may advance, after considerable experience, to supervisory or administrative positions in their own or other organizations; some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some become consultants; and others, who have the doctorate, may become professors in the guidance field.

### Employment Outlook

Vocational counselors who have a master's degree and those who have recognized related experience in the field will have excellent employment opportunities in both public and private agencies through the 1970's. In addition, college graduates with a bachelor's degree and 15 hours of undergraduate or graduate work in counselor related courses who are interested in becoming counselor trainees will find many opportunities in State and local employment service offices.

The employment of counselors in State employment service offices is expected to increase rapidly through the 1970's. Among the factors contributing to the increasing demand for counseling services in these offices are three recent major Federal laws: the Vocational Education Act of 1963, which provides for vocational guidance and counseling for people who are out of school and seeking employment; the Manpower Development and Training Act of 1962, as amended, which provides for counseling in connection with the occupational training or retraining of large numbers of unemployed work-

ers; and the Economic Opportunity Act of 1964, as amended, which provides for counseling to implement such programs as Job Corps, Neighborhood Youth Corps, Work Training, Work Experience, and Urban and Rural Community Action. State employment service offices also will employ additional counselors to work with older persons, American Indians, and inmates of correctional institutions. Moreover, population growth and particularly the large number of young workers entering the labor force each year will be reflected in larger numbers seeking vocational counseling.

In addition to the counselors needed to take care of growth in the occupation, many more will be needed to replace workers who retire, die, or leave the profession for other reasons, each year through the 1970's.

### Earnings and Working Conditions

The annual average (mean) salary for employment counselors in State employment service offices in 1966 was about \$6,400. Salaries ranged up to \$11,000 for highly experienced counselors. Trainees for vocational counseling positions in some voluntary agencies in large cities were being hired at about \$5,500 a year; annual salaries reported for experienced counselors ranged up to \$15,000 or more in early 1967.

Most counselors work about 40 hours a week and have various benefits, including vacations, sick leave, pension plans, and insurance coverage. Counselors employed in community agencies may work overtime.

### Where To Go for More Information

General information on employment or vocational counseling may be obtained from:

National Vocational Guidance Association, Inc.,  
1605 New Hampshire Ave. NW.,  
Washington, D.C. 20009.

National Employment Counselors  
Association,  
1605 New Hampshire Ave., NW.,  
Washington, D.C. 20009.

United States Department of Labor,  
Bureau of Employment Security,  
U.S. Employment Service, Branch of  
Counseling and Testing Services,  
Washington, D.C. 20210.

Information on entrance requirements for positions in the public employment service offices may be obtained from the State civil service or merit system office in each State capital, or from local employment offices.

A list of private agencies offering vocational counseling services that

meet certain professional criteria set forth by the American Board on Counseling Services, Inc., is provided in the *Directory of Approved Counseling Agencies, 1967-68*, available from the American Personnel and Guidance Association, Inc., 1605 New Hampshire Ave. NW., Washington, D.C. 20009, at \$2.50 a copy.

## Nature of Work

Engineers develop methods for converting the raw materials and sources of power found in nature into useful products at a reasonable cost in time and money. They use basic scientific principles to solve the practical problems involved in designing goods and services and developing methods for their production. The emphasis on the application of scientific principles, rather than on their discovery, is the main factor that distinguishes the work of the engineer from that of the scientist. For example, a physicist may discover that the properties of a gas change when it is converted into a liquid at extremely low temperatures, but it is the engineer who develops uses for the liquid, or economical methods for its production.

In designing or developing a new product, engineers must consider many factors. For example, in designing a space capsule they must calculate just how much heat, radiation, air pressure, and other forces the capsule must withstand during its flight. Experiments must be conducted which relate these factors to various construction materials, as well as to the many possible capsule sizes, shapes, and weights. In addition, the engineer must take into account the relative cost of the required materials and the cost and time of the fabrication process. Similar factors must be considered by engineers who design and develop a wide variety of products ranging from transistor radios and washing machines to electronic computers and industrial machinery.

Besides design and development, engineers are engaged in many other activities. Many work in inspection, quality control, and other activities related to production in manufacturing industries, mines, and farms. Others are in administrative and management positions where knowledge of engineering methods is of great importance. A large number plan and supervise the construction of buildings and highways. Many are

employed in sales positions, where they must discuss the technical aspects of a product or assist in planning its installation or use. (See statement on Manufacturers' Salesmen.) Some conduct research aimed at supplying the basic technological data needed for the design and production of new or improved products. Some engineers with considerable experience work as consultants. A relatively small group teach in the engineering schools of colleges and universities.

Most engineers specialize in one of the many branches of the profession. More than 25 engineering specialties are recognized by the profession or in engineering school curriculums. Besides these major branches—10 of which are discussed separately in this chapter—there are many subdivisions of the branches. Structural and highway engineering, for example, are subdivisions of civil engineering. Engineers may also become specialists in the engineering problems of one industry, or in a particular field of technology such as propulsion or guidance systems. Nevertheless, the basic knowledge required for all areas of engineering often makes it possible for engineers to shift from one field of specialization to another, particularly for those beginning their careers.

Engineers within each of the branches may apply their specialized knowledge to engineering problems in many fields. For example, electrical engineers may work in the fields of medicine, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some applied fields cuts across the traditional branches. Thus, engineers in one field often work closely with specialists in other scientific and engineering occupations.

## Where Employed

Engineering is the second largest professional occupation, exceeded in size only by teaching; for men it is the largest profession. Approximately 1 million engineers were employed in the United States in early 1967.

## ENGINEERING

Engineers contribute in countless ways to the welfare, technological progress, and defense of the Nation. They develop complex electric power, water supply, and waste disposal systems to meet the problems of urban living. They design industrial machinery and equipment needed to manufacture goods on a mass production basis, and heating, air conditioning, and ventilation equipment for the comfort of man. Also, they develop scientific equipment to help probe the mysteries of outer space and the depths of the ocean, and design and supervise the construction of highways and rapid transit systems for safe and more convenient transportation. In addition, they design and develop consumer products such as automobiles and refrigerators.

This chapter contains an overall discussion of engineering, followed by separate statements on several branches of the field—aerospace, agricultural, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining, engineering. Although most engineers specialize in these or other specific branches of the profession, a considerable body of basic knowledge and methodology is common to most areas of engineering. Therefore, young people considering engineering as a career should become familiar with the general nature of engineering as well as with its various branches.



Manufacturing industries employed more than half of all engineers—about 550,000 in early 1967. The manufacturing industries employing the largest numbers of engineers were the electrical equipment, aircraft and parts, machinery, chemicals, ordnance, instruments, primary metals, and fabricated metal products industries. About 275,000 engineers were employed in nonmanufacturing industries in early 1967, primarily in the construction, public utilities, engineering and architectural services, and business and management consulting services industries.

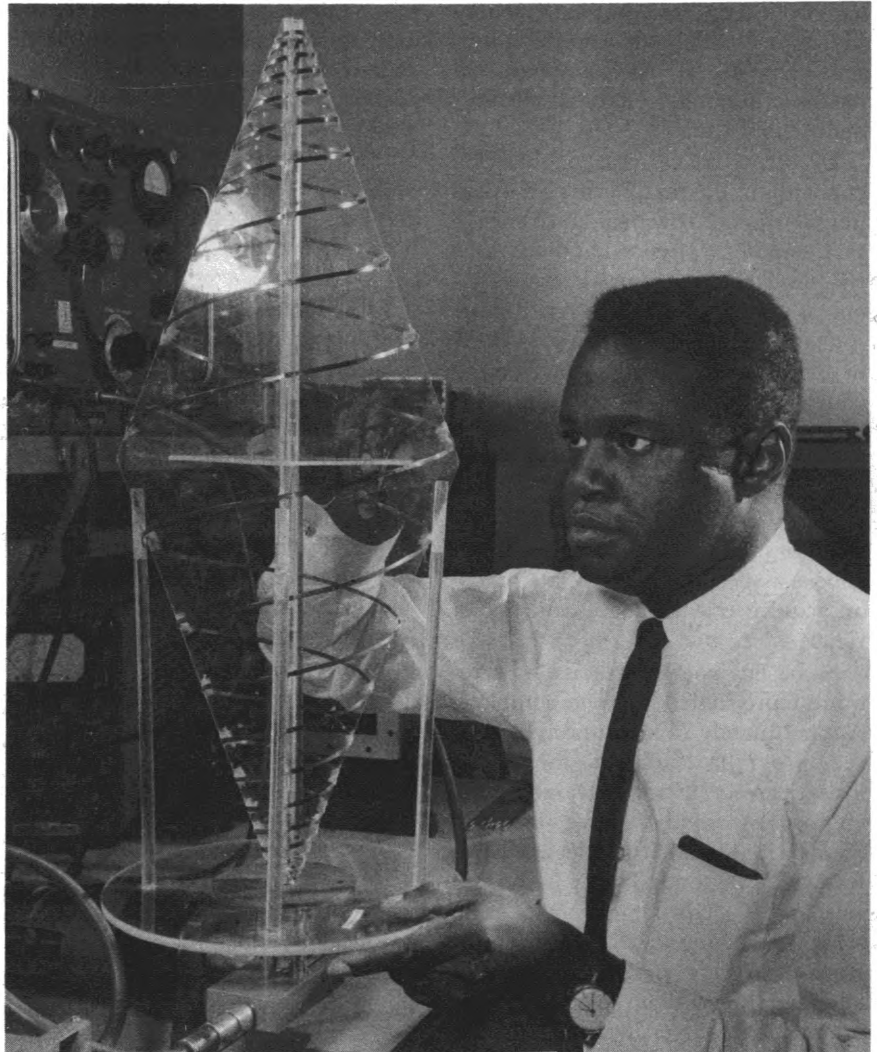
Federal, State, and local government agencies employed another large group of engineers—more than 150,000 in early 1967. About half of these were employed by the Federal Government, chiefly by the Department of Defense. Other Federal agencies which employed significant numbers of engineers were the Departments of the Interior, Agriculture, and Commerce, and the National Aeronautics and Space Administration. Most engineers in State and local government agencies were employed by highway and public works departments.

Educational institutions employed almost 40,000 engineers in early 1967, in research as well as in teaching positions. A small number were employed by nonprofit research organizations.

Engineers are employed in every State, in small cities as well as large, and in some rural areas. The profession also offers opportunities for employment overseas. Some branches of engineering are concentrated in particular industries, as indicated in the statements presented later in this chapter.

### **Training, Other Qualifications, and Advancement**

A bachelor's degree in engineering is the generally accepted educational requirement for entrance into engineering positions. Well-qualified col-



**Many engineers are engaged in research and development work.**

lege graduates with training in physics, one of the other natural sciences, or in mathematics may qualify for some beginning positions in engineering. Some persons without a degree are able to become engineers after long experience in a related occupation—such as draftsmen or engineering technician—and some college-level training.

Advanced training is being emphasized for an increasing number of jobs. Graduate degrees are desirable for beginning teaching and research positions, and are helpful for advancement in most types of work. Furthermore, in some engineering specialties, such as nuclear engineer-

ing, training is generally available only at the graduate level.

Education leading to a bachelor's degree in engineering is offered by about 250 colleges, universities, and engineering schools located throughout the country. Although curriculums in the larger branches of engineering are offered in most schools, some of the smaller engineering specialties are taught in relatively few institutions. A student who desires to specialize in one of the smaller branches should, therefore, investigate the curriculums offered by the various schools before selecting his college. For admission to an undergraduate program, engineering

schools usually require high school courses in mathematics and the physical sciences and place emphasis on the general quality of the applicant's high school work.

In the typical 4-year engineering curriculum, the first 2 years are spent mainly in studying basic science—mathematics, physics, and chemistry—and the humanities, social sciences, and English. The last 2 years are devoted chiefly to advanced study in basic science, and to engineering courses with emphasis on the branch of engineering in which the student is specializing. Some engineering programs offer only general engineering training in the undergraduate curriculum, allowing the student to choose a specialty in graduate school or acquire one through work experience.

Some engineering curriculums require more than 4 years to complete. Approximately 25 institutions have 5-year programs leading to the bachelor's degree. In addition, about 50 engineering schools have arrangements with liberal arts colleges whereby a student spends 3 years in the college and 2 years in the engineering school, receiving a bachelor's degree from each. This type of program usually offers the student an opportunity for greater diversification in his studies.

Some institutions have 5- or 6-year cooperative plans under which students spend alternate periods in engineering school and in employment in industry or government. Under most such plans, classroom study is coordinated with practical industrial experience. In addition to the practical experience he gains in this type of program, the student is provided an opportunity to finance part of his education.

Engineering graduates usually begin work as trainees or as assistants to experienced engineers. Many large companies have special training programs for their beginning engineers which are designed to acquaint them with specific industrial practices. These programs are valuable in deter-

mining the type of work for which the individual is best suited. As they gain experience, engineers may move up to positions of greater responsibility. Those with proven ability are often able to advance to the high-level technical and administrative positions, and an increasingly large number are being promoted to top executive posts.

All 50 States and the District of Columbia have laws providing for the licensing (or registration) of those engineers whose work may affect life, health, or property; or who offer their services to the public. In 1966, about 270,000 engineers were registered under these laws in the United States. Generally, registration requirements include graduation from an accredited engineering curriculum, plus at least 4 years of experience and the passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

### Employment Outlook

Employment opportunities for engineers are expected to be very good through the 1970's. Engineering has been one of the fastest growing professions in recent years and requirements for engineers are expected to increase very rapidly. However, engineers who are not well grounded in engineering fundamentals and those whose specialization is very narrow could be affected adversely by skill obsolescence caused by shifts in defense activities and by rapidly changing technology. There will probably be an especially strong demand for new engineering graduates who have training in the most recently developed engineering principles and techniques, and for engineers who can apply engineering principles to the medical and other sciences. New graduates with advanced degrees will have excellent opportunities in research and teaching.

Among the factors underlying the anticipated increase in demand for engineers is the growth in population,

and the resulting expansion of industry to meet the demand for additional goods and services. The need for engineers will probably also rise as a result of the increasingly larger amount of engineering time required for the development of complex industrial products and processes and the increasing automation of industry.

Another factor which will tend to increase the demand for engineers is the expected continued growth of expenditures for research and development. Such expenditures have increased very rapidly in recent years, and it is likely that they will continue to rise through the 1970's, although somewhat more slowly than in the past. The growth of research activities will result in the expansion of existing fields of work and in the creation of new ones, especially in the fields of automated machinery and computers.

The level of defense expenditures is an important determinant of the demand for engineers, because a large proportion of all engineers (at least 25 percent in 1965) are engaged in activities related to national defense. The outlook for engineers is based on the assumption that defense activity in the late 1970's will approximate the level prior to the Vietnam buildup.

In addition to the engineers needed to fill new positions, thousands more will have to be trained to replace those who transfer to other occupations, retire, or die. These losses to the profession are expected to create over 40,000 job openings annually through the 1970's.

Along with the anticipated growth in demand for engineers, the number of new engineering graduates at all academic levels is also projected to increase in the late 1960's and during the 1970's. Despite this increase, the number of new graduates seeking employment in the profession may still fall short of demand. Thus, employment opportunities for new graduates will probably continue to be very good through the 1970's. Women engineers, who represent less than 1 percent of the profession, are also ex-

pected to have favorable employment opportunities.

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

**Earnings and Working Conditions**

Average (median) starting salaries for engineering graduates with the bachelor's degree were about \$8,300

a year in private industry in mid-1966, according to a survey conducted by the Engineering Manpower Commission. Graduates with the master's degree and no experience usually received from \$1,000 to \$2,000 a year more than those with only the bachelor's degree. Salaries for graduates with the doctor's degree were generally between \$11,000 and \$14,500 a year.

Starting salaries for new engineering graduates with the bachelor's degree varied considerably by industry, as may be seen in the following tabulation based on the same 1966 survey.

Industry	Median <sup>1</sup>	Upper decile <sup>2</sup>	Lower decile <sup>3</sup>
Aerospace and defense.....	\$8,450	\$9,400	\$7,400
Business machines.....	8,550	9,700	8,000
Chemicals.....	8,450	8,950	7,600
Construction.....	8,250	8,900	7,100
Consulting and engineering.....	7,750	8,900	7,050
Electrical equipment.....	8,300	9,200	7,300
Electronic equipment.....	8,350	9,000	7,250
Machinery.....	8,250	9,000	7,250
Petroleum.....	8,400	8,950	7,500
Research and development activities.....	8,500	9,250	7,650
Utilities.....	7,950	8,850	7,150

<sup>1</sup> 50 percent earned more and 50 percent earned less than amounts shown.

<sup>2</sup> 10 percent earned more than amounts shown.

<sup>3</sup> 90 percent earned more than amounts shown.

In the Federal Government service in early 1967, engineers with the bachelor's degree and no experience could start at \$6,387 or \$7,729 a year, depending on their college records. Beginning engineers with the bachelor's degree and 1 or 2 years of graduate work could start at \$7,729 or \$9,001. Those with the Ph. D. degree could begin at \$10,481 or \$11,306.

In colleges and universities, the salary of beginning engineers with the bachelor's degree averaged about \$6,800 a year; with the master's degree, \$7,600 a year; and with the Ph. D. degree, \$9,900. (Also see statement on College and University Teachers.)

Most engineers can look forward to an increase in earnings as they gain experience. For example, in industry in 1966, the average (median) salary of engineers with 21 to 23 years of experience was about \$15,500, nearly twice that of beginning engineers. Only 10 percent of those with 21 to 23 years of experience earned less than \$11,100 a year, and over 10

percent earned \$22,200 or more. A small number in top-level executive positions had much higher earnings.

Although engineers generally work under quiet conditions found in modern offices and research laboratories, they may be involved in more active work—at a missile site preceding the launching of a space vehicle, in a mine, at a construction site, or at some other out-of-doors location.

**Where To Go for More Information**

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

Engineers' Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

Engineering Manpower Commission, Engineers Joint Council, 345 East 47th St., New York, N.Y. 10017.

National Society of Professional Engineers, 2029 K St. NW., Washington, D.C. 20006.

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. Information on registration of engineers may be obtained from the National Society of Professional Engineers.

In addition to the organizations listed above, other engineering societies represent the individual branches of the engineering profession; some are listed with the branches presented later in this chapter. Many other engineering organizations are listed in the following publications available in most libraries.

Engineering Societies Directory, 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 labor unions. Information on engineering unions may be obtained from:

The American Federation of Technical Engineers (AFL-CIO), 900 F St. NW., Washington, D.C. 20004.

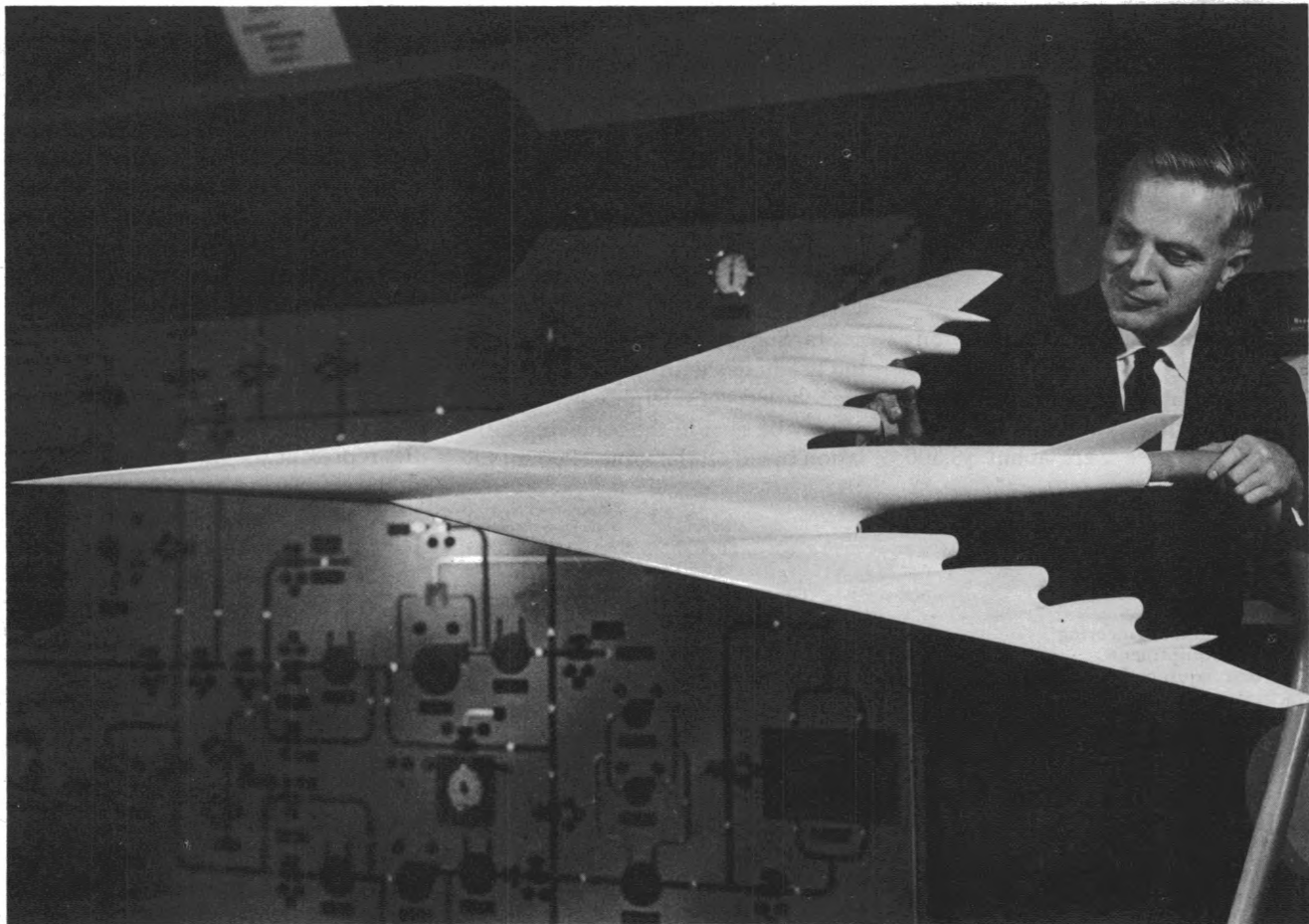
**AEROSPACE ENGINEERS**

(D.O.T. 013.081)

**Nature of Work**

Aerospace engineers play a vital role in America's space age activities. Engineers in this branch of the profession work on all types of aircraft and spacecraft including missiles, rockets, and conventional propeller-driven and jet-powered planes. They are concerned with all phases of the development of aerospace products from the initial planning and design to the final manufacture and testing.

Aerospace engineers usually specialize in a particular area of work,



Aerospace engineer inspects research model of new aircraft.

such as structural design, guidance and control, instrumentation, propulsion, materials, testing, or production methods. They may also specialize in a particular type of aerospace product such as conventional passenger planes, jet-powered military aircraft, rockets, satellites, or manned space capsules. Engineers working in the conventional aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft are often referred to as astronautical engineers.

### Where Employed

More than 55,000 aerospace engineers were employed in early 1967, mainly in the aircraft and parts industry. Some worked for Federal

Government agencies, primarily the National Aeronautics and Space Administration and the Department of Defense. Small numbers worked for commercial airlines, consulting firms, and colleges and universities.

### Employment Outlook

Employment opportunities for aerospace engineers are expected to be favorable through the 1970's. Continuing developments in supersonic, subsonic, and vertical lift aircraft and advancement in space and missile activities should result in a moderate increase in requirements for aerospace engineers. Additional job opportunities will also rise from the need to replace engineers who transfer to other fields of work, retire, or die.

However, engineers who are not well grounded in engineering fundamentals, and those whose specialization is very narrow could be affected adversely by skill obsolescence caused by shifts in defense activities and by rapidly changing technology.

The level of defense expenditures is an important determinant of the demand for aerospace engineers because the majority of these engineers are engaged in activities related to national defense. If defense activity should differ substantially from the level prior to the Vietnam buildup, the demand for aerospace engineers will be affected accordingly. (See introductory section of this chapter for discussion on training requirements and earnings. See also chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

## Where To Go for More Information

American Institute of Aeronautics and Astronautics, Inc.,  
1290 Avenue of the Americas,  
New York, N.Y. 10019.

## AGRICULTURAL ENGINEERS

(D.O.T. 013.081)

### Nature of Work

Agricultural engineers use basic engineering principles and concepts to develop equipment and methods to improve the efficiency and economy of the production, processing, and distribution of food and other agricultural products. They are concerned primarily with the design of farm machinery, equipment, and structures; the utilization of electrical energy on farms and in food and feed processing plants; the conservation and management of soil and water resources; and the design and operation of processing equipment to prepare agricultural products for market. They usually specialize in a particular area of work, such as research and development, design, testing and application, production, sales, or management.

### Where Employed

Most of the estimated 10,000 agricultural engineers in early 1967, were employed in private industry, especially by manufacturers of farm equipment and specialized lines of field, barnyard, processing, and household equipment; electrical service companies; and distributors of farm equipment and supplies. Some worked for engineering consultants who supply technical or management services to farmers and farm related industries; others were independent consultants.

The Federal Government employs about 1,000 agricultural engineers—chiefly in the Soil Conservation Service and Agricultural Research

Service of the Department of Agriculture. Colleges and universities employed nearly an equal number. A few were employed by State and local governments.

### Employment Outlook

Employment of agricultural engineers is expected to grow moderately through the 1970's. Among the factors which will contribute to a greater demand for these engineers are the growing mechanization of farm operations, increasing emphasis on conservation of resources, expanding population—with a corresponding demand for food and fibre—and the broadening use of agricultural products and wastes as industrial raw materials. Additional engineers will be needed to work on problems concerning the enormous energy and power requirements of farms. (See introductory section of this chapter for discussion on training requirements and earnings. See also chapter on Occupations in Agriculture.)

## Where To Go for More Information

American Society of Agricultural Engineers,  
420 Main St., St. Joseph, Mich. 49085

## CERAMIC ENGINEERS

(D.O.T. 006.081)

### Nature of Work

Ceramic engineers develop methods for processing clay, silicates, and other nonmetallic minerals into a wide variety of ceramic products, ranging from glassware, cement, and bricks, to coatings and refractories for missile nose cones. They may also design and supervise the construction of the plant and equipment used in the manufacture of these products. Many ceramic engineers are engaged in research and development work.

Some are employed in administration, production, and sales; others work as consultants or teach in colleges and universities.

Ceramic engineers usually specialize in one or more products—for example, products of 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); protective and refractory coatings for metals; glass; abrasives; and fuel elements for atomic energy.

### Where Employed

Most of the estimated 5,000 to 10,000 ceramic engineers in early 1967 were employed in manufacturing industries—primarily in the stone, clay, and glass industries. Others worked in the iron and steel, electrical equipment, aerospace, and chemicals industries which produce or use ceramic products. Some were employed by educational institutions, independent research organizations, and the Federal Government.

### Employment Outlook

The outlook is for moderate growth in the employment of ceramic engineers through the 1970's. Although ceramic engineering is a small field and the number of openings in any one year will be small compared with those in the large branches of engineering, the number of graduates with degrees in ceramic engineering is also small. Thus, opportunities for new graduates should be excellent.

The growth of programs related to nuclear energy, electronics, and space exploration will provide many of the opportunities for ceramic engineers. Ceramic materials which are corrosion-resistant, and capable of withstanding radiation and extremely high temperatures are becoming increasingly important in the development of nuclear reactors and space

vehicles. Increasing use of the more traditional ceramic products such as whiteware and abrasives, both for consumer and industrial use, will also require additional ceramic engineers to improve and adapt these products to new requirements. The growing use of structural clay and tile products in construction will add to employment opportunities in the production of these items. Furthermore, the development of new glasses of unusual properties and the expanding use of conventional glasses in the construction and in the container field probably will create additional openings for ceramic engineers. (See introductory section of this chapter for discussion on training requirements and earnings.)

#### Where To Go for More Information

National Institute of Ceramic Engineers,  
4055 North High St., Columbus,  
Ohio 43214.

### CHEMICAL ENGINEERS

(D.O.T. 008.081)

#### Nature of Work

Chemical engineers designed the chemical plants and equipment required to manufacture chemicals. They also determine the best combination of the many chemical operations that will result in the most effective manufacturing process. They often test their work by designing and operating pilot plants.

The work in this branch of engineering is so diversified and complex that chemical engineers frequently become specialists in a particular type of chemical operation such as oxidation, polymerization, distillation, or hydrogenation. Others specialize in the manufacture of a specific product such as plastics, paper, or rubber. Chemical engineers may be engaged in research and development, produc-

tion, plant operation, design, sales, management, or teaching.

#### Where Employed

Approximately four-fifths of the estimated 50,000 chemical engineers in the United States in early 1967 were employed in manufacturing industries—primarily in the chemicals industry. Some were employed by government agencies and by colleges and universities. A small number worked for independent research institutes or engineering consulting firms, or as independent consulting engineers.

#### Employment Outlook

The outlook is for rapid growth of employment in chemical engineering through the 1970's. The major factors underlying this expected growth are expansion of industry—the chemicals industry in particular—and continued high levels of expenditures for research and development, in which about one-third of all chemical engineers are employed. The growing complexity of chemical processes and the automation of these processes, especially in the chemicals and petroleum industries, will require additional chemical engineers for work related to designing, building, and maintaining the necessary plants and equipment. Chemical engineers will also be needed in many relatively new areas of work, such as the design and development of nuclear reactors and nuclear fuel processing for industrial use, and research aimed at developing new and better solid and liquid fuels for rockets. Furthermore, the development of new chemicals for use in the manufacture of consumer goods such as fertilizers, drugs, and paints will probably create additional openings for chemical engineers. (See introductory section of this chapter for discussion on training requirements and earnings. See also statement on Chemists and chapter on Occupations in the Industrial Chemical Industry.)

#### Where To Go for More Information

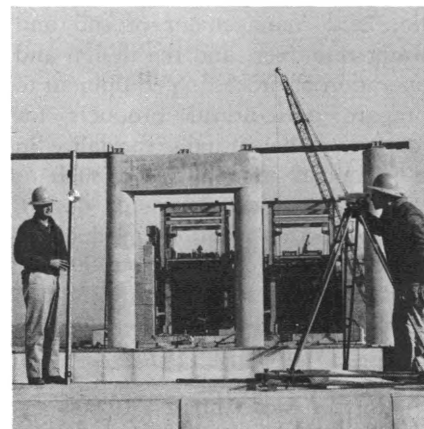
American Institute of Chemical Engineers,  
345 East 47th St., New York,  
N.Y. 10017.

### CIVIL ENGINEERS

(D.O.T. 005.081)

#### Nature of Work

Civil engineers design and supervise the construction of roads, harbors, airfields, tunnels, bridges, water supply and sewage systems, buildings, and many other types of structures. Civil engineering is so broad that many specialties have developed within it—among them are structural, highway, hydraulic, and sanitary engineering.



Many civil engineers are in supervisory or administrative positions, ranging from that of site supervisor of a construction project or head of a drafting department to top-level executive positions. Some are engaged in design, planning, research, inspection, or maintenance activities. Others teach in colleges and universities or work as consultants.

#### Where Employed

More than 180,000 civil engineers were employed in the United States

in early 1967. The majority were employed by Federal, State, and local government agencies and the construction industry. Large numbers were employed by consulting engineering and architectural firms, or worked as independent consulting engineers. Some were employed by public utilities, railroads, and educational institutions. Others worked in the iron and steel industries and other major manufacturing industries.

Civil engineers work in all parts of the country, in every State and city—usually in or near the major industrial and commercial centers. However, since these 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, civil engineers in some positions are often required to move from place to place to work on different projects.

### Employment Outlook

The outlook in civil engineering—one of the largest and oldest branches of the profession—is for continued growth through the 1970's.

The expanding employment opportunities for civil engineers will result from the growing needs for housing, industrial buildings, and highways created by an increasing population and expanding economy. Work related to the problems of urban living, such as water and sewage systems, air and water pollution, and giant urban redevelopment projects, may also require additional civil engineers.

Large numbers of civil engineers will be needed each year to replace those who retire or die. The number of civil engineers needed annually to fill such vacancies—estimated to be about 3,400 in 1966—will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

### Where To Go for More Information

American Society of Civil Engineers,  
345 East 47th St., New York, N.Y.  
10017.

### ELECTRICAL ENGINEERS

(D.O.T. 003.081, 151, and 187)

#### Nature of Work

Electrical engineers design, develop, and supervise the manufacture of electrical and electronic equipment—including electric motors and generators; communications equipment; electronic apparatus such as television, radar, computers, and missile guidance systems; and electrical appliances of all kinds. They also design and participate in the operation of facilities for generating and distributing electric power.

Electrical engineers usually specialize in a major area of work such as electronics, electrical equipment manufacturing, communications, or power. Many specialize in subdivisions of these broad areas; for example, electronics engineers may specialize in computers, or in missile guidance and tracking systems.

A large number of electrical engineers are engaged in research, development, and design activities. Another large group is employed in administrative and management positions. Others are employed in various manufacturing operations, or in technical sales or teaching positions.

#### Where Employed

Electrical engineering is the largest branch of the profession. It is estimated that approximately 220,000 electrical engineers were employed in the United States in early 1967. They were employed chiefly by manufacturers of electrical and electronic equipment, aircraft and parts, business machines, and professional and scientific equipment. Many were em-

ployed by telephone and telegraph and electric light and power companies. Sizable numbers were employed by government agencies and by colleges and universities. Others worked for construction firms, for engineering consultants, or as independent consulting engineers.

### Employment Outlook

Employment opportunities for electrical engineers are expected to increase very rapidly through the 1970's. An increased demand for electrical equipment to automatically control production processes, using such items as computers and sensing devices, is expected to be among the major factors contributing to this growth. The anticipated growing need for electrical and electronic consumer goods is also expected to create many job openings for electrical engineers.

A large number of electrical engineers are engaged in defense and space work. Employment of electrical engineers in defense activities during the 1970's should not vary significantly from current levels, assuming defense activity in the late 1970's approximates the level prior to the Vietnam buildup.

In addition to those needed to fill new positions, many electrical engineers will be required to replace personnel lost to the profession because of retirement or death. The number needed to fill such vacancies, estimated to be about 2,200 in 1966, will probably rise slowly in the future. (See introductory section of this chapter for discussion of training requirements and earnings. See also chapter on Occupations in Electronics Manufacturing.)

### Where To Go for More Information

Institute of Electrical and Electronic Engineers,  
345 East 47th St., New York, N.Y.  
10017.

## INDUSTRIAL ENGINEERS

(D.O.T. 012.081, .168 and .188)

Industrial engineers determine the most effective methods of using the basic factors of production—manpower, machines, and materials. They are concerned with people and “things,” in contrast to engineers in other specialties who generally, are concerned more with developmental work in subject fields, such as power, mechanics, structures, or materials.

They may design systems for data processing and apply operations research techniques to complex organizational, production, and related problems. Industrial engineers also develop management control systems to aid in financial planning and cost analysis; design production planning and control systems to insure coordination of activities, and to control the quality of products; and may design and improve systems for the physical distribution of goods and services.

Other activities of industrial engineers include plant location surveys, where consideration is given to sources of raw materials, availability of a work force, financing, and taxes; and the development of wage and salary administration and job evaluation programs.

### Where Employed

More than two-thirds of the estimated 115,000 industrial engineers employed in early 1967 were in manufacturing industries. They were more widely distributed among manufacturing industries than were those in other branches of engineering. Some worked for insurance companies, construction and mining firms, and public utilities. Others were employed by retail organizations and other large business enterprises to improve operating efficiency. Still others worked for government agencies, educational institutions, and consulting engineer-

ing firms. A few were independent consulting engineers.

### Employment Outlook

The outlook is for continued rapid growth of employment in this branch of the profession through the 1970's. The increasing complexity of industrial operations and the expansion of automated processes, coupled with the continued growth of the Nation's industries, are among the major factors expected to increase the demand for industrial engineers. Growing recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity is also expected to stimulate the demand for persons in this branch of engineering.

Besides those needed to fill new positions, additional numbers of industrial engineers will be required each year to replace those who retire or die. The number needed to fill such vacancies, estimated to be approximately 1,300 in 1966 will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

### Where To Go for More Information

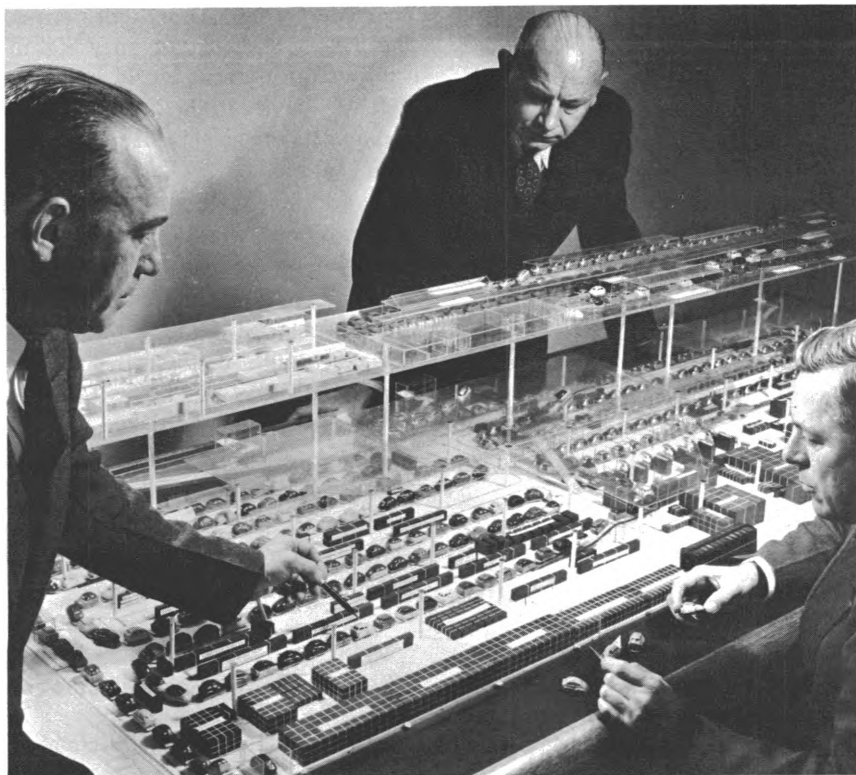
American Institute of Industrial Engineers,  
345 East 47th St., New York, N.Y.  
10017.

## MECHANICAL ENGINEERS

(D.O.T. 007.081, .151, .168, .181, and .187; 011.081; and 019.187)

### Nature of Work

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines which produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines, and nu-



Industrial engineers plan production operations.



clear reactors. They also design and develop a great variety of machines which use power—refrigeration and air-conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others.

Many specialized areas of work have developed within mechanical engineering. Among these specialties are those concerned with motor vehicles, marine equipment, railroad equipment, rocket engines, steam-power, heating, ventilating and air conditioning, hydraulics or fluid mechanics, instrumentation, ordnance, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

Large numbers of mechanical engineers are engaged in research, development, and design. Many are also employed in administrative and management activities. Others work in maintenance, sales, and activities related to production and operations in manufacturing industries. Some teach in colleges and universities or work as consultants.

### Where Employed

Almost 200,000 mechanical engineers were employed in the United States in early 1967. Nearly all manufacturing and nonmanufacturing industries employed some members of the profession. However, nearly three-fourths of all mechanical engineers were employed in manufacturing industries—mainly in the primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others were employed in government agencies, educational institutions, and consulting engineering firms. Some worked as independent consulting engineers.

### Employment Outlook

The outlook in mechanical engineering—the second largest branch of the profession—is for rapid growth through the 1970's. The expected ex-

pansion of industry with the consequent demand for industrial machinery and machine tools, and the increasing technological complexity of industrial machinery and processes will be among the major factors contributing to greater employment. Continued growth of expenditures for research and development will also be a factor in the growth of this branch of the profession. Moreover, newer areas of work, such as atomic energy and aerospace development, will probably provide additional openings for large numbers of mechanical engineers.

Besides those needed to fill new positions, large numbers of mechanical engineers will be required each year to replace those who retire or die. The number needed to fill such vacancies, estimated to be about 2,700 in 1966 will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

### Where To Go for More Information

The American Society of Mechanical Engineers,  
United Engineering Center,  
345 East 47th St., New York, N.Y.  
10017.

### METALLURGICAL ENGINEERS

(D.O.T. 011.081)

### Nature of Work

Metallurgical engineers develop methods of processing and converting metals into useful products. These engineers usually work in 1 of 2 main branches of metallurgy—extractive or physical. Extractive metallurgy deals with the extraction of metals from their ores, and with refining them to obtain pure metal. Physical metallurgy deals with the properties of metals and their alloys, and with methods of converting refined metals into useful final products. Persons working in the field of metallurgy

may be referred to as either metallurgists or metallurgical engineers.

### Where Employed

The metal working industries—primarily the iron and steel and nonferrous metals industries—employed over one-half of the estimated 5,000 to 10,000 metallurgical engineers in early 1967. Many metallurgical engineers worked in the machinery, electrical equipment, and aircraft and parts industries. Others were employed in the mining industry, and in government agencies, consulting firms, independent research organizations, and educational institutions.

### Employment Outlook

Employment in this small branch of the profession is expected to grow rapidly through the 1970's. Increasing numbers of metallurgical engineers will be needed by the metal-working industries to work on problems involved in the adaptation of metals and alloys to new needs. For example, the development of such products as supersonic jet aircraft, missiles, satellites, and spacecraft has brought about a need for lightweight metals capable of withstanding both extremely high and extremely low temperatures. Metallurgical engineers will also be needed to solve metallurgical problems connected with the efficient use of nuclear energy. Furthermore, as the supply of high-grade ores diminishes, more metallurgical engineers will be needed to find ways of processing low-grade ores now regarded as unprofitable to mine. (See introductory section of this chapter for discussion on training requirements and earnings. Also see chapter on Occupations in the Iron and Steel Industry.)

### Where To Go for More Information

American Institute of Mining, Metallurgical, and Petroleum Engineers,  
345 East 47th St., New York, N.Y.  
10017.

## MINING ENGINEERS

(D.O.T. 010.081, .168, and .187)

### Nature of Work

Mining engineers are responsible for the extraction of minerals from the earth and for the preparation of minerals for use by manufacturing industries. They design the layouts of mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods of transporting extracted minerals to processing plants. Mining engineers are responsible for the efficient operation of mines and mine safety, including ventilation, water supply, communications, and maintenance of equipment. Some mining engineers work with geologists, locating and appraising new ore deposits. Others conduct research to develop new mining equipment and to devise improved methods of processing extracted minerals.

Mining engineers frequently specialize in the extraction of specific metal ores or coal and other non-metallic minerals. Engineers who specialize in the extraction of petroleum

and natural gas are usually considered members of a separate branch of the profession—Petroleum Engineering.

### Where Employed

Approximately three-quarters of the estimated 13,500 mining engineers were employed in the mining and petroleum industries in early 1967. Most of the remainder worked in colleges and universities or government agencies, or as independent consultants.

Mining engineers are usually employed at the location of mineral deposits, often near small communities. However, those engaged in research, teaching, management, or consulting, are often located in large metropolitan areas.

### Employment Outlook

Employment opportunities for mining engineers are expected to be favorable for the remainder of this decade and throughout the 1970's. The number of new graduates in mining engineering entering the industry is expected to be fewer than the number of mining engineers who retire,

transfer to other fields of work, or die. For example, it is estimated that about 200 mining engineers retired or died in 1966, while only 153 bachelor degrees were granted in mining engineering.

Exploration for minerals is increasing, both in the United States and in other parts of the world. Easily mined deposits are being depleted, creating a growing need for engineers to mine newly discovered mineral deposits and to devise more efficient methods for mining low-grade ores. Additional employment opportunities for mining engineers will arise as the development of new alloys and discovery of new uses for metals increases the demand for less widely used ores. Recovery of metals from the sea and the development of oil shale deposits could present major challenges to the mining engineer in the future. (See introductory section to chapter for discussion on training requirements and earnings. See also chapter on Petroleum Production and Refining.)

### Where To Go for More Information

American Institute of Mining, Metallurgical, and Petroleum Engineers,  
345 East 47th St., New York, N.Y.  
10017.

## HEALTH SERVICE OCCUPATIONS

Almost everyone knows something about the professional services provided by doctors, dentists, and pharmacists. Many people also have some firsthand knowledge of the duties performed by nurses, attendants, and other workers who take care of patients in hospitals. Less well known, but also of great importance to the public health, is the large number of people employed behind the scenes in other health service occupations, such as laboratory or X-ray technician. Altogether, about 3 million people were employed in health occupations in 1966. Employment in this field has increased rapidly in recent years.

Nurses, physicians, pharmacists, and dentists constituted the largest number in the professional health occupations in 1966, ranging from nearly 100,000 dentists to about 620,000 registered professional nurses. Other professional health occupations with sizable employment are dietitian, veterinarian, optometrist, chiropractor, osteopathic physician, and hospital administrator. Other health service workers include technicians of various types, such as medical technologist, medical X-ray technician, dental hygienist, and dental laboratory technician. Large numbers—nearly 1 million—worked as practical nurses and auxiliary nursing workers, including orderlies, nursing aids, hospital attendants, and psychiatric assistants.

Workers in the health field are employed in hospitals, clinics, laboratories, pharmacies, nursing homes, industrial plants, public health agencies, mental health centers, private offices, and patients' homes. Those employed in health occupations work mainly in the more heavily populated and prosperous sections of the Nation.

Many women are employed in the health field. Nursing, the largest of the major health service occupations, is second only to teaching as a field of professional employment for women. Other health service occupations in which women predominate are practical nurse, medical X-ray technician, medical technologist, dietitian, physical therapist, occupational therapist, speech pathologist and audiologist, dental hygienist, and medical record librarian. On the other hand, the majority of dentists, optometrists, physicians, veterinarians, pharmacists, hospital administrators, and sanitarians are men.

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations can be entered with little specialized training.

A continued rapid expansion of employment in the health field is expected through the 1970's, although the rates of growth will differ considerably among individual health occupations. The factors which are expected to contribute to an increase in the demand for health care are the following: The country's expanding population; wider health education and the resultant rising health consciousness of the general public; growth of coverage under prepayment programs for hospitalization and medical care, including Medicare; rapid expansion of expenditures for medical research; and increasing ex-

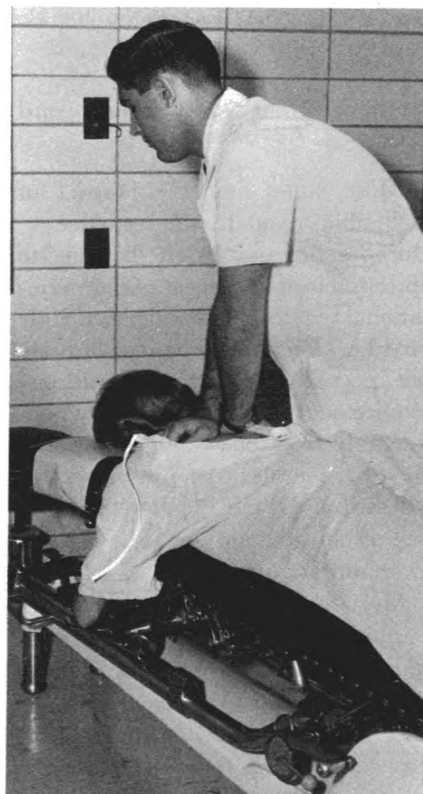
penditures by Federal, State, and local governments for health care and services. In addition, many new workers will be needed each year to replace those who retire, die, or—particularly in the case of women—leave the field for other reasons. Thus, there will be many opportunities for employment in the health services.

### CHIROPRACTORS

(D.O.T. 079.108)

#### Nature of Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by his nervous system, and that interference with this system impairs his normal functions and lowers his resistance to disease. Chiropractors treat their patients primarily by manual manipulation of parts of the body, especially the spinal column. Many



Chiropractor adjusts patient's spine.

also use such supplementary measures as water, light, and heat therapy and prescribe diet, exercise, and rest. Because of the emphasis on the importance of the spine and its position, most chiropractors use X-ray extensively to aid in locating the source of patients' difficulties. Chiropractic as a system for healing does not include the use of drugs or surgery.

### Where Employed

About 23,500 chiropractors were employed in the United States in early 1967; about 9 percent were women. Most chiropractors were engaged in independent private practice. Some were salaried assistants of established practitioners, or worked for chiropractic clinics and industrial firms. Others taught or conducted research at chiropractic colleges. About 45 percent of all chiropractors were located in California, New York, Texas, Missouri, and Pennsylvania.

### Training, Other Qualifications, and Advancement

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. The type of practice permitted and the educational requirements for licensure vary considerably from one State to another. In 1967, the States of Louisiana and Mississippi did not regulate the practice of chiropractic nor issue licenses to chiropractors.

Most States require the successful completion of a 4-year chiropractic course following high school graduation. About one-half of the States also require 1 or 2 years of preparatory college work before chiropractic training. About half the States also require that chiropractors pass a basic science examination. Chiropractors licensed in one State generally may

obtain a license in another State without further examination.

Some of the 12 chiropractic colleges in the United States in 1967 restricted their teaching to manipulation and spinal adjustments, while the others offered a broader curriculum including such subjects as chiropractic physiotherapy and nutrition. In most chiropractic colleges, 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 colleges' clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Among the personal qualities considered desirable for a chiropractor is the ability to deal with people sympathetically. The work requires considerable hand dexterity but does not call for unusual strength or endurance.

Most newly licensed chiropractors either set up a new practice or purchase an established practice. Some start as salaried chiropractors to acquire experience and funds necessary to establish their own practice. A moderate financial investment is usually necessary to open and equip an office.

### Employment Outlook

The employment outlook for chiropractors is expected to be favorable through the 1970's. Only a slight increase in the demand for chiropractic services is expected, but the number of new graduates of chiropractic colleges also is expected to be small and probably will be barely enough to fill openings left by chiropractors who retire, die, or stop practicing for other reasons. In view of the trend in many States toward raising educational requirements for chiropractic practice, opportunities may be best for those with the most thorough training.

Opportunities for new graduates to begin their own practice are likely to be best in those parts of the country where chiropractic is most fully accepted as a method of treatment. Opportunities also should be good for those who wish to enter salaried positions in chiropractic clinics, chiropractic colleges, and other organizations employing chiropractors.

The expected slight growth in demand for chiropractors' services will be related to an expanding population and its increasing demand for various types of health care, including chiropractic treatment.

Women are expected to have good opportunities in chiropractic, since some women and children prefer to be treated by women chiropractors. All chiropractic colleges 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. Though incomes of chiropractors vary widely, experienced chiropractors generally had average yearly incomes ranging from \$11,000 to \$16,000 in early 1967, according to the limited data available.

### Where To Go for More Information

Information on State licensing requirements may be obtained from 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:

American Chiropractic Association,  
American Building, 2200 Grand Ave.,  
P.O. Box 1535, Des Moines, Iowa  
50306.

International Chiropractors Association,  
741 Brady St., Davenport, Iowa  
52805.

## DENTAL HYGIENISTS

(D.O.T. 078.368)

### Nature of Work

Dental hygienists work under the supervision of a dentist; they clean teeth by removing stains and calcium deposits, polish teeth, and massage gums. While performing this work (oral prophylaxis), they chart conditions of decay and disease for diagnosis by the dentist. They may also take and develop X-rays, mix filling compounds, apply solutions to the teeth for the control of dental decay, administer prescribed medicaments, sterilize instruments, and act as chair-side assistants to the dentists. Hygienists provide dental health education, including the techniques of mouth care and proper diet.

Dental hygienists working in school systems promote dental health by examining children's teeth, assisting dentists in determining the dental treatment needed, and reporting their findings to parents. They also perform oral prophylaxes and give instruction on correct care and brushing of teeth. Some help to develop classroom projects or assembly programs on oral health. Dental hygienists employed by health agencies work on dental health projects or perform clinical duties. A few assist in research projects. Those with advanced training may teach in schools of dental hygiene.

### Where Employed

Approximately 16,000 dental hygienists were employed in 1966; almost all were women. Many work part time. The majority of all dental hygienists were employed in private dental offices; about one-fourth worked for public health agencies or school systems; and others worked in industrial plants, clinics, hospitals, dental hygiene schools, and as civilian employees of the Armed Forces.

Although some hygienists are employed in small towns, the majority work in metropolitan areas.



### Training and Other Qualifications

Dental hygienists must pass an examination to be licensed by the State in which they wish to practice. In all States except Alabama and Georgia, eligibility for a license is limited to graduates of accredited dental hygiene schools. In 1966, candidates could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners in 41 States. Upon being licensed, a hygienist becomes a Registered Dental Hygienist (R.D.H.). In order to practice in a different State, a licensed

dental hygienist must take that State's examination.

In 1967, 60 schools of dental hygiene in the United States were accredited or provisionally accredited by the Council on Dental Education of the American Dental Association. Most of these schools provide a 2-year dental hygiene certification course. Some have 4-year programs leading to the bachelor's degree, and others offer both programs. Programs leading to a master's degree are offered in three schools.

For dental hygienists interested in practicing in a private dental office, completion of the 2-year program is

usually sufficient. In order to work in research, teaching, and in public or school health programs, the completion of a 4-year program is usually required.

The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools which offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. The majority of schools also require that applicants take aptitude tests conducted by the American Dental Hygienists' Association.

The curriculum at a school of dental hygiene consists of courses in the basic sciences, dental sciences, and liberal arts. These schools offer laboratory work, clinical experience, and classroom instruction in such subjects as anatomy, chemistry, histology, pathology, pharmacology, and nutrition. The ability to work well with people, and patience as well as manual dexterity and attentiveness to detail are essential in this field.

### Employment Outlook

Employment opportunities for dental hygienists are expected to be excellent through the 1970's. Despite the anticipated continued rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment, as in recent years.

The demand for hygienists is expected to grow as a result of the expanding population and the growing awareness of the importance of regular dental care. Increasing interest in dental care programs for children will lead to more employment opportunities in school systems. Increased participation in dental prepayment plans and more group practice among dentists may also result in new jobs for dental hygienists. In addition, a great number of job openings will be created by young women leaving their jobs for marriage and family responsibilities.

Mature women who wish to return to the field and those who desire part-time positions can expect to find good opportunities for employment.

### Earnings and Working Conditions

Earnings of dental hygienists are affected by the type of employer, education, and experience of the individual hygienist, and the part of the country in which the job is located. Dental hygienists working in private dental offices are usually salaried employees although some are paid a commission for work performed or a combination of salary and commission. Those employed in research, administrative, supervisory, or teaching positions often earn higher salaries.

Salaries of dental hygienists employed full time in private offices averaged about \$5,500 a year in 1965, according to a survey conducted by the American Dental Association. The annual beginning salary for a dental hygienist employed by the Federal Government was either \$4,776 or \$5,331 in early 1967, depending on education and experience. Most of those in the Federal Government earned between \$5,300 and \$6,000 per year.

Dental hygienists employed full time in private offices usually work between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two dentists or more.

Most dental hygienists are employed in clean, well-lighted offices but may have to stand for long periods of time. Regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection are important health protections for persons in this occupation.

A paid vacation of 2 or 3 weeks is common among hygienists who work full time in dental offices. Dental hygienists employed by school systems, health agencies, and the Federal or State governments have the same hours, vacation, sick leave, and re-

irement benefits as other workers in these organizations.

### Where To Go for More Information

Information about approved schools and the educational requirements needed to enter this field may be obtained from:

American Dental Hygienists' Association,  
211 East Chicago Ave., Chicago, Ill.  
60611.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in each State.

### DENTAL LABORATORY TECHNICIANS

(D.O.T. 712.381)

#### Nature of Work

Artificial dentures—teeth, crowns, bridges, and other dental and orthodontal appliances—used to be made by dentists. Now, dental laboratory technicians do most of this highly skilled work. These technicians do not deal directly with patients but receive prescriptions from dentists.

In making many kinds of artificial dentures, dental laboratory technicians form models in dental stone (hard plaster) from impressions of patients' mouths taken by dentists. They also may make metal castings for dentures, polish and finish dentures, construct metal or porcelain crowns or inlays for partially destroyed teeth, make gold and other metal bridges, and make appliances to correct such abnormalities as cleft palates. In performing this work, dental laboratory technicians use small handtools, special electric lathes and drills, high-heat furnaces, and other kinds of specialized laboratory equipment.

Some dental laboratory technicians do all types of dental laboratory work. Others specialize in such areas as

fabricating crowns and bridges, arranging artificial teeth on dental appliances so that they function properly, processing plastic materials, working with dental ceramics (porcelain), or making castings of gold or nonprecious metal alloys used in dentistry. In beginning jobs, trainees usually perform relatively simple jobs such as mixing and pouring plaster into casts and molds. As they gain experience, they are assigned more difficult laboratory work and may use expensive metals.

### Where Employed

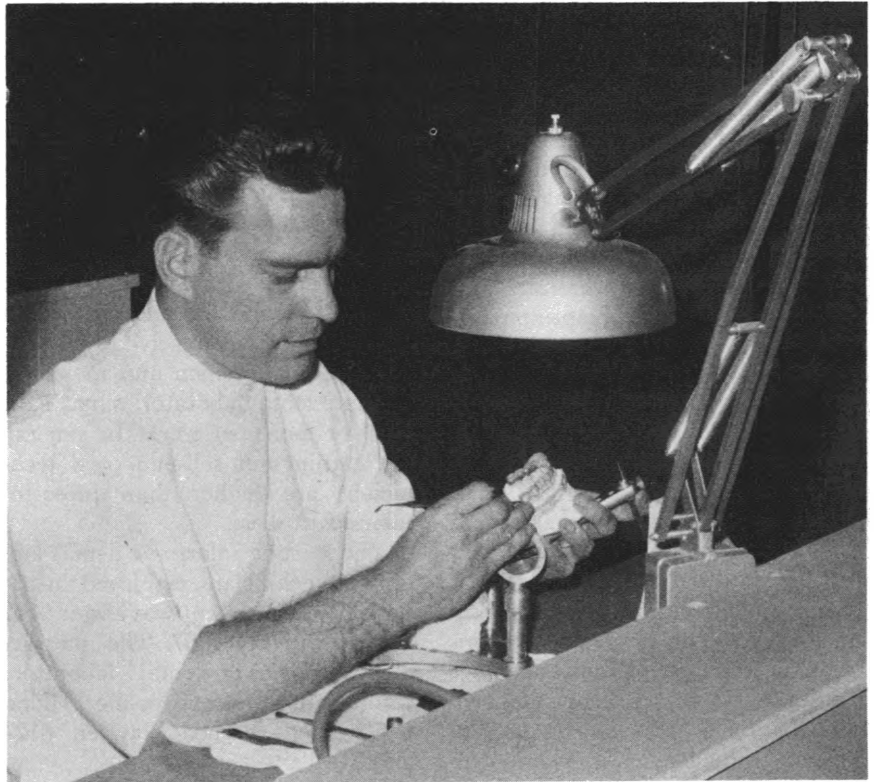
An estimated 26,000 dental laboratory technicians were employed in 1966. Most of these technicians worked in commercial laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from dentists, are usually one- or two-man shops. However, a few large laboratories employ many technicians.

About 4,000 dental laboratory technicians were employed by individual dentists. Some worked in hospitals that provided dental services. Others were employed by the Federal Government, chiefly in the Veterans Administration and in the Department of the Army. Women, who account for about 10 percent of all dental laboratory technicians, worked mainly in large commercial laboratories.

Dental laboratory technicians, like the dentists who use their services, are located mainly in cities and in the States with large populations.

### Training, Other Qualifications, and Advancement

Although no minimum formal educational requirements prevail for entry into this occupation, graduation from high school is an asset. The most common method of becoming a dental laboratory technician is to secure a trainee position and learn the craft on the job, usually in a commercial



Dental laboratory technician forms dentures.

laboratory or a hospital offering dental services. Typically, on-the-job training lasts 3 or 4 years, depending on such factors as the trainee's previous experience, his ability to master the techniques, and the number of specialized areas to be learned. Courses in dental laboratory work are offered in some public vocational high schools and junior colleges; the course-work may be taken in conjunction with on-the-job training. Persons also may qualify by taking 1- to 2-year programs in dental laboratory technology offered by a few schools. But regardless of a student's educational background, employers consider actual work experience to be necessary for an applicant to qualify as a full-fledged technician.

In 1967, 10 schools, accredited by the American Dental Association, offered 2-year educational programs to high school graduates (or those with equivalent education). The first year of training in these schools includes formal classroom instruction in dental

law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student is provided supervised practical experience in the school or a dental laboratory. After completion of the 2-year training program, an additional 3 years of practical experience in a dental office or a laboratory generally is needed to become recognized as a well-qualified dental technician.

A formal apprenticeship program was instituted in 1966 by the National Association of Certified Dental Laboratories. The program includes about 8,000 hours of on-the-job training and a minimum of 144 hours a year of related home study.

The National Association of Certified Dental Laboratories sponsors a certification program for dental laboratory technicians who can meet certain training and other requirements. Certification may become important for obtaining employment as a dental laboratory technician, because many employers are likely to

regard it as evidence of the technician's competence.

Among the personal qualifications which employers look for in selecting trainees are a high degree of manual dexterity, good color preception, patience, and a liking for detailed work. Preference also may be given to young people who have completed high school courses in art, ceramics and pottery, sculpturing, blueprint reading, plastics and metalworking.

### Employment Outlook

Job opportunities for both well-qualified craftsmen and for specialists are expected to be very good through the 1970's. Opportunities for trainees should be very favorable also. In addition to an expected rapid increase in employment, many openings for dental laboratory technicians will probably occur because of the need to replace technicians who transfer to other fields of work, retire, or die.

Opportunities for salaried employment for both experienced and trainee dental laboratory technicians will be best in commercial laboratories and in the Federal Government. Some experienced technicians also should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospect of building a successful business.

Among the factors underlying the expected rapid growth in demand are the growing public awareness of the importance of preventive dentistry; the availability of new dental prepayment plans to help people of moderate income; and the increasing number of older people with an accompanying increase in the number of persons requiring artificial dentures. Moreover, the number of dentists is not expected to keep pace with the demand for their services; hence, in order to devote more time to treatment of patients, dentists will send more and more of their laboratory work to commercial firms.

### Earnings and Working Conditions

Apprentice or beginning dental laboratory technicians employed in commercial laboratories in 1966 usually earned between \$56 and \$80 a week. Experienced technicians in commercial laboratories generally earned between \$100 and \$150 a week, depending on their skill level and experience. Ceramist technicians and crown and bridge technicians received the highest salaries. Foremen and managers in large dental laboratories may earn \$200 or more per week. In general, net earnings of self-employed technicians are higher than those of salaried workers.

The starting salary for dental laboratory technicians employed in the Federal Government was about \$102 a week in early 1967. The majority of experienced dental laboratory technicians employed in the Federal Government earned between \$124 and \$140 a week.

Salaried technicians usually work the standard 40-hour week, but self-employed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations, and some also are provided paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

The work of dental laboratory technicians is not strenuous and most jobs can be done by handicapped workers provided they have good use of their hands and fingers.

### Where To Go for More Information

Information about the training and lists of approved schools are available from:

American Dental Association, Council on Dental Education,  
211 East Chicago Ave., Chicago,  
Ill. 60611.

Information on career opportunities in commercial laboratories, scholarships, requirements for certi-

fication, and apprenticeship programs may be obtained from:

National Association of Certified  
Dental Laboratories, Inc.,  
1330 Massachusetts Ave. NW., Wash-  
ington, D.C. 20005.

### DENTISTS

(D.O.T. 072.108)

### Nature of Work

Dentists look for and fill cavities in the teeth, straighten teeth, take X-rays of the mouth, and treat gum diseases. Dentists also extract teeth and substitute artificial dentures especially designed for the individual patient. In addition, they clean teeth and examine the mouth for diseases. They spend most of their time with patients, but some time may be devoted to laboratory work such as making dentures and inlays. Many dentists, however—particularly in large cities—send most of their laboratory work to commercial firms. Some dentists employ dental hygienists to clean patients' teeth. (See statement on Dental Hygienists.) They also employ other assistants who perform office work and assist the dentist in his "chairside" duties.

Most dentists are general practitioners who provide many types of dental care; only about 6 percent are recognized as specialists. More than half of these specialists are orthodontists, who straighten teeth. The next larger number, oral surgeons, perform operations in the mouth and jaws. The remainder specialize in periodontology (treating the tissues that support the teeth), prosthodontics (making artificial teeth or dentures), pedodontics (dentistry for children), oral pathology (diseases of the mouth), endodontics (root canal therapy), and public health dentistry.

About 3 percent of all dentists are employed primarily in work that does not involve "chairside" practice, such as teaching and research. Many dentists in private practice, however, do this work on a part-time basis.



### Where Employed

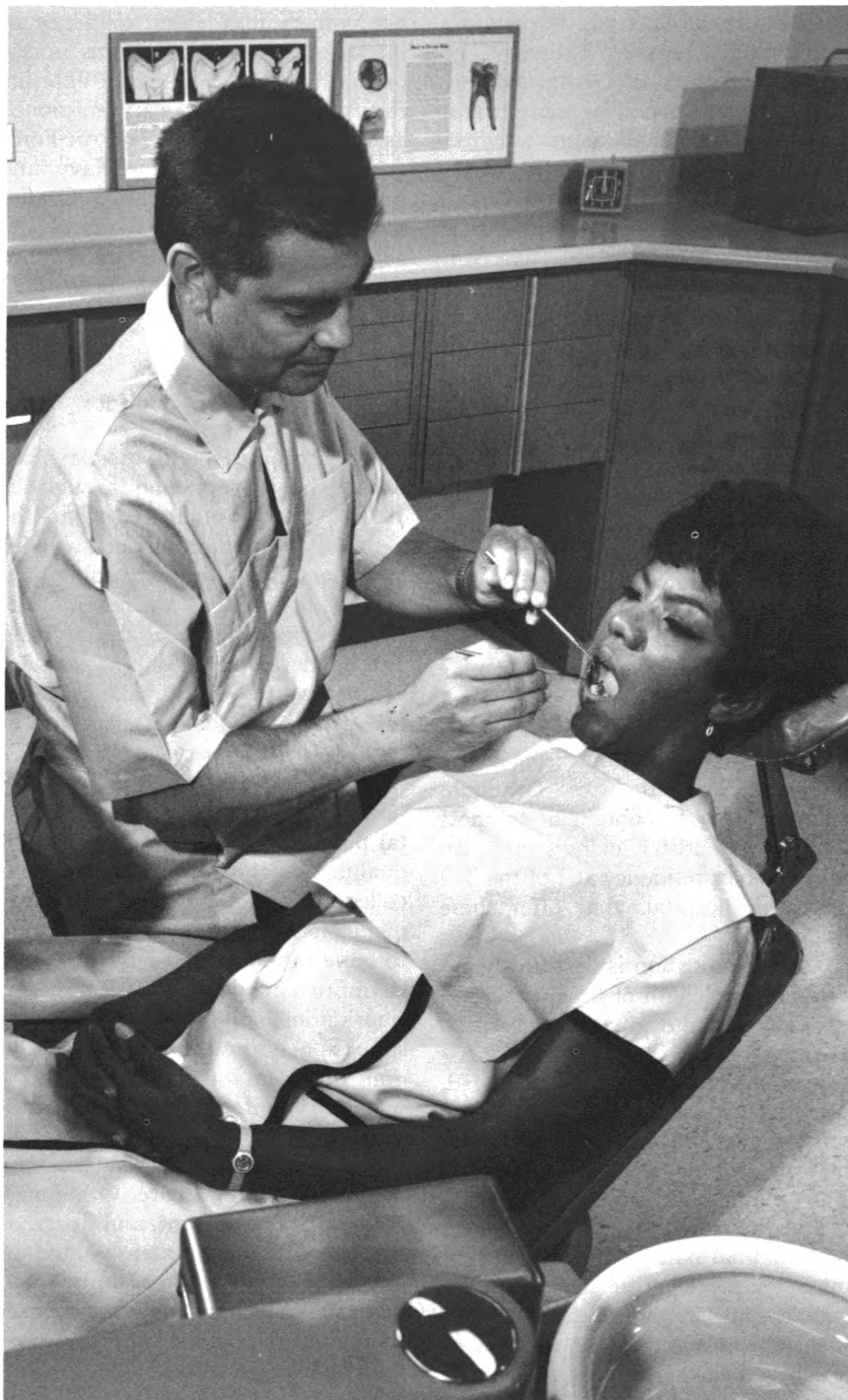
About 97,500 dentists were at work in the United States in 1966. Nine out of every ten were in private practice. Of the remainder, about 6,500 served as commissioned officers in the Armed Forces; about 1,300 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service; and about 1,200 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists represented only about 2 percent of the profession.

Dentists tend to be concentrated in large cities and in populous States. In 1966, about a third of all dentists were located in the four States of New York, California, Pennsylvania, and Illinois.

### Training, Other Qualifications, and Advancement

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. In 1966, 44 States and the District of Columbia recognized the examination given by the National Board of Dental Examiners as a substitute for the written part of the State Board examinations. 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 10 States, however, a dentist cannot be licensed as a "specialist" unless he has 2 or 3 years of graduate education, several years of specialized experience, and passes a special State examination. Few States permit dentists licensed in other States to practice in their jurisdictions without further examination.

The minimum education requirements for graduation from an approved dental school is 2 years of pre-dental college work followed by 4



years of professional dental school training; 7 of the 49 dental schools in operation in the United States in 1966 required 3 years of pre-dental study. Pre-dental education must include at least a half-year course in organic chemistry and full-year

courses in English, biology, physics, and inorganic chemistry.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in basic sciences such as anatomy, bacteriology, and pharmacology. The last 2

years are spent chiefly in the school's dental clinic, treating patients. The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.) is conferred by a few schools.

Competition is keen for admittance to dental schools. In selecting students, schools give considerable weight to college grades and amount of college education; more than half of the students enrolling in dental schools have bachelor's degrees. In addition, all dental schools participate in a nationwide aptitude testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dentists interested in research or teaching, or in becoming specialists, often take graduate work. Graduate training may be obtained at most schools of dentistry, or by serving an internship or residency at 1 of the 270 approved hospitals that offer these programs.

Dental education is very costly because of the length of time it takes to earn the dental degree. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships up to \$2,500 a year to help needy students pursue full-time study leading to the degree.

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

The majority of newly qualified dentists open their own offices or purchase established practices. Some start in practice with established dentists, to gain experience and to save the money required to equip an of-

fice; others may enter residency or internship training programs in approved hospitals. Dentists entering the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy, 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

Opportunities for dentists are expected to be very good through the 1970's. It is anticipated that the demand for dental services will increase along with an expanding population; the growing awareness of the importance of regular dental care, and the development of new payment arrangements which make it easier for people of moderate means to obtain dental service. Expanded dental research activities will require more trained personnel; dental public health programs will need qualified administrators; and dental colleges will need additional faculty members. Many dentists will continue to serve in the Armed Forces.

Improved dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, but such measures—by preserving teeth that might otherwise be extracted—may tend to increase rather than decrease the demand for dental care. Other new techniques, equipment, and drugs, as well as the more extensive use of dental hygienists, assistants, and laboratory technicians may permit individual dentists to care for more patients. However, these developments are not expected to offset the need for more dentists.

Over the next decade, the number of dental school graduates will be barely enough to maintain the present ratio of dentists to population. The majority of graduates will be needed to replace dentists who retire or die. Thus, the outlook for those who complete dental training

is very good. Despite this favorable outlook, the number of men and women who will be able to enter this field will be restricted by the present limited capacity of dental schools. However, opportunities to obtain dental training are expected to increase because of recent Federal legislation which provides Federal funds to assist in the construction of additional training facilities for dentists.

### Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. Average income above expenses for all self-employed dentists in 1966 was about \$21,000 a year. In the Federal Government, new graduates of dental schools in early 1967 could receive starting yearly salaries ranging from \$9,221 to \$12,056, depending on college records and other qualifications.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas, dental services are in greater demand; however, a practice can be developed most quickly in small towns where new dentists can easily become known and where there may be less competition with established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than that in larger communities.

Most dental offices are open 5 days a week and some dentists have evening hours. Dentists usually work between 40 and 50 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, since the hours of work are usually determined by the dentist himself. A considerable number con-

tinue in part-time practice well beyond the usual retirement age.

### Where To Go for More Information

People wishing to practice in a given State should get the requirements for licensure directly from the board of dental 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,  
211 East Chicago Ave., Chicago, Ill.  
60611.

American Association of Dental Schools,  
211 East Chicago Ave., Chicago, Ill.  
60611.

## DIETITIANS

(D.O.T. 077.081 through .168)

### Nature of Work

Dietitians plan appetizing and nutritious meals to help people maintain or recover good health. Their work includes selecting foods; planning general menus and modified diets that meet nutritional requirements for health or for medical treatment; supervising the personnel who prepare and serve the meals; managing purchases and accounts; and providing guidance on good eating habits. Administrative dietitians form the largest group in this occupation; the others are therapeutic dietitians, teachers, or research workers.

Administrative dietitians apply the principles of nutrition and sound management to large-scale meal planning and preparation such as that done in hospitals, universities, schools, and other institutions. They supervise the preparation of meals; select, train, and direct food-service supervisors and workers; arrange for the buying of food, equipment, and supplies; enforce sanitary and safety regulations;

and prepare records and reports. Dietitians who are directors of a dietary department also formulate departmental policy; coordinate dietary service with the activities of other departments; and are responsible for the development and management of the dietary department budget, which in large organizations may amount to millions of dollars annually.

Therapeutic dietitians plan and supervise the preparation of special meals for patients on modified diets, taking into consideration the nutritional value of foods. They discuss food likes and dislikes with patients and note their intake of food. Other duties of therapeutic dietitians include conferring with doctors regarding patients' diets, instructing patients and their families on the requirements and importance of their diets, and

suggesting ways to help them stay on these diets after leaving the hospital. In a small institution, one person may serve as both the administrative and therapeutic dietitian.

Some dietitians, particularly those in hospitals affiliated with medical centers, teach dietetic, medical, dental, and nursing students such subjects as dietetics, foods and nutrition, and diet therapy. A few dietitians act as consultants to commercial enterprises, including food processors, equipment manufacturers, and utility companies.

Other members of the profession, called public health nutritionists, conduct studies or surveys of food and nutrition. They also take part in research projects, such as those concerned with the nutritional needs of the aging, persons with chronic diseases, or space travelers.



Dietitian supervises meal preparation.

### Where Employed

Approximately 30,000 dietitians were employed in 1967, of whom less than 10 percent were men. More than two-fifths of all the dietitians worked in hospitals and related institutions, including about 1,100 who were employed by the Veterans Administration and the U.S. Public Health Service. A sizable number were employed by colleges, universities, and school systems as teachers or as dietitians in food-service programs. Most of the remainder worked for public health agencies, restaurants or cafeterias, and large companies that operate food-service programs for their employees. Some dietitians were commissioned officers in the Armed Forces.

### Training, Other Qualifications, and Advancement

The minimum educational requirement for dietitians is a bachelor's degree with a major in foods and nutrition or institution management. This education can be obtained in about 350 colleges and universities. Undergraduate work should include courses in foods and nutrition, institution management, chemistry, bacteriology, and physiology, and such related courses as mathematics, psychology, sociology, and economics.

To qualify for professional recognition, The American Dietetic Association recommends the completion of a 1-year dietetic internship program approved by the Association, or 3 years of experience. Many employers prefer to hire dietitians who have completed an internship. An important phase of the intern's education is on-the-job experience; the remainder of the internship is devoted to classroom study of menu planning, budgeting, institution management, other advanced subjects, and to special projects. In 1967, 65 internship programs were approved by The American Dietetic Association—56

for hospitals, 8 for business firms or colleges and universities, and 1 for a food clinic.

Experienced dietitians may be advanced to assistant director or director of a dietary department in a large hospital or other institution. Graduate education is usually required for advancement to higher level positions in teaching and research. Those interested in becoming public health nutritionists must usually earn a graduate degree in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Qualifications needed for work in this field are an interest in and an aptitude for the sciences, particularly chemistry and mathematics. Ability to organize and manage work programs and to work well with others is also important.

### Employment Outlook

Opportunities for qualified dietitians are expected to be excellent through the 1970's. The supply of trained dietitians is expected to be considerably less than the demand for them. As a result, opportunities will be good for college graduates with suitable undergraduate education to assist dietitians. Small hospitals and other institutions that cannot obtain dietitians for full-time positions may employ them on a part-time basis.

The major factors expected to contribute to increasing opportunities for dietitians include the expansion of hospital and nursing home facilities, more widespread use of hospitals and medical services by an increasing population, and the growth of community health programs. An increasing number of dietitians will also be needed to direct food services for schools, industrial plants, and commercial eating places, and to engage in food and nutrition research programs. In addition, since many women select this field because of their interest in food and homemak-

ing and then leave the profession for marriage and family responsibilities, replacement needs will probably continue to be high.

The number of men employed as dietitians has been growing slowly but steadily. Men are likely to find increasing employment opportunities, especially as administrative dietitians in college and university food services, hospitals, and commercial eating places.

### Earnings and Working Conditions

In early 1967, hospitals offered new graduates of approved internship programs annual salaries ranging from \$6,000 to \$6,500, according to The American Dietetic Association. New graduates without internship generally received lower starting salaries. Experienced dietitians in hospitals were paid between \$6,500 and \$10,000 a year. Staff dietitians employed by college and school food services received annual salaries ranging from \$6,000 to \$8,000.

The entrance salary in the Federal Government for those who had completed internship was \$6,451 a year in early 1967. Beginning dietitians with a master's degree could start at \$7,696 per year. Most experienced dietitians employed by the Federal Government earned between \$7,500 and \$13,000 per year; a few earned over \$14,000. Dietitians employed by State and local governments in mid-1966 received yearly salaries ranging from about \$6,700 to \$8,600, according to a survey made by the U.S. Department of Health, Education, and Welfare.

Most dietitians are employed on a weekly work schedule of 40 hours; however, dietitians in hospitals may sometimes work on weekends, and those in commercial food service have somewhat irregular hours. Some hospitals provide laundry service and meals in addition to salary. Paid vacations, holidays, and health and retirement benefits are usually received.

### Where To Go for More Information

Information on approved dietetic internship programs, scholarships, and employment opportunities, and a list of colleges providing training for a professional career in dietetics, may be obtained from:

The American Dietetic Association,  
620 North Michigan Ave., Chicago,  
Ill. 60611.

The U.S. Civil Service Commission, Washington, D.C. 20415, has information on the requirements for dietetic interns and dietitians in Federal Government hospitals.

### HOSPITAL ADMINISTRATORS

(D.O.T. 187.118)

#### Nature of Work

Hospital administrators hold the top-level executive job in a hospital. They have responsibility for directing all the administrative activities of the hospital. General guidance for their work comes from a governing board with whom they work closely in the development of plans and policies.

The day-to-day work of administrators involves direction of the many and varied activities of the hospital. They work closely with the medical and nursing staffs and make available to them the necessary personnel, equipment, and auxiliary services. Administrators are responsible for hiring and training personnel; preparing and administering the budget; establishing accounting procedures; planning current and future space needs; insuring the proper maintenance of buildings and equipment; purchasing supplies and equipment; and providing for laundry, mail, telephone, information, and other services for the patients and staff.

In small hospitals, typically located in rural or suburban areas, the administrator generally assumes all management functions. In large hospitals, he is assisted by specialists who have



Hospital administrator plans additional facilities.

been trained in hospital administration.

Under the direction of the governing board, administrators may carry out large projects concerned with expanding or developing the hospital's services. For example, they may organize fund-raising campaigns or plan new building or research programs.

Administrators meet regularly with their staff to discuss progress, make plans, and solve problems concerning the functioning of the hospital. In cooperation with the medical staff and department heads, they also may develop and maintain teaching programs for nurses, interns, and other hospital staff members. They may

address community gatherings, organize community health campaigns, represent their hospitals at meetings, or participate in study groups.

#### Where Employed

About 15,000 hospital administrators were employed in hospitals and related institutions in 1967. About two-thirds of them worked in non-profit or private hospitals, and the remainder generally worked in Federal, State, and local government hospitals. Of those employed by the Federal Government, most were in Veterans Administration, Armed

Forces, and Public Health Service hospitals. It is estimated that one-fifth of the total number of hospital administrators and their assistants are women. Many are members of religious orders.

### **Training, Other Qualifications, and Advancement**

The background needed to qualify for this work depends, to a large extent, on the qualifications established by individual employers. Most employers prefer persons with at least a master's degree in hospital administration. Others look for people who have formal training in law or business administration and also extensive experience in the health field. A few require that their administrators be physicians or registered professional nurses. Specialized hospitals (such as orthopedic or mental hospitals) frequently prefer physicians for administrators whose medical specialty is the same as that of the hospital. Hospitals run by religious groups may seek administrators of the same faith.

In 1967, master's degree programs in hospital administration were offered in 24 colleges and universities. These programs usually consist of a year of academic study followed by a year of administrative residency in a selected hospital; some require 2 years of academic study. For entrance into these programs, applicants must have a bachelor's degree including some courses in the natural sciences, psychology, sociology, statistics, accounting, and economics. The curriculum may include such courses as hospital organization and management, accounting and budget control, personnel administration, public health administration, and the economics of health care. The residency involves an orientation to all of the hospital's activities under the supervision of the administrator or his assistant. The American College of Hospital Administrators provides financial loans and scholarships to a limited number of students for graduate work in hospital administration.

The U.S. Public Health Service also gives a few awards for graduate work in this field.

New graduates with a master's degree in hospital administration usually enter the field as assistant administrators or department heads. As they gain experience, they may qualify for the hospital administrator job. A Ph. D. in hospital administration, which is offered in three universities, is helpful for those interested in teaching and research.

Some persons without a master's degree in hospital administration gain experience that may qualify them for advancement to the administrator's job by working in one of the specialized administrative areas such as personnel, records, budget and finance, or data processing. With this experience and some graduate work, they may be promoted to department head, assistant administrator, and eventually to administrator.

Personal qualifications needed for success in this field include good health and vitality as well as interest in helping the sick. Skills in working with people, organizing and directing large-scale activities, and public speaking are important assets.

### **Employment Outlook**

New graduates with the master's degree in hospital administration are expected to have excellent employment opportunities. Applicants without graduate training will find it difficult to enter this field except by gaining experience at the lower level jobs.

The position of hospital administrator, especially in a large hospital, represents a career goal, and these positions are likely to continue to be filled by promotion from within or by transfers from smaller hospitals. Although graduates of hospital administration programs are usually preferred for such advancement, some positions as administrator are likely to continue to be filled by physicians and nurses.

The number of positions in hospital administration is expected to grow rapidly throughout the 1970's. As more and larger hospitals are built to take care of the increasing population, and as health services are expanded, more positions are likely to be created for hospital administrators, assistants, and department heads to handle the increase in management functions. These positions will provide additional employment and promotional opportunities, especially for graduates of schools of hospital administration. Such graduates also will find increasing employment opportunities outside of hospitals in hospitalization and health insurance programs, nursing homes and other long-term care institutions, rehabilitation facilities, and public health centers.

### **Earnings and Working Conditions**

Salaries of hospital administrators depend on factors such as the type of hospital, the size of its administrative staff and budget, and the policy of the governing board. New hospital administration graduates employed in private hospitals received about \$7,500 a year in early 1967; experienced administrators generally earned up to \$18,000 or more, according to the limited data available. New graduates employed in Veterans Administration hospitals started at \$7,696 a year in early 1967, although a few experienced VA hospital administrators, most of whom are physicians, were paid up to \$25,000 a year.

Commissioned officers in the Armed Forces and in the U.S. Public Health Service working in the field of hospital administration hold ranks ranging from second lieutenant to colonel. Commanding officers of large Armed Forces hospitals are physicians, and they may hold higher ranks.

Hospital administrators often work long hours. Since hospitals operate on a round-the-clock basis, the administrator may be called upon to settle emergency problems at any time of

the day or night. Fringe benefits usually include paid vacations and holidays, sick leave, and pension and insurance coverage.

### Where To Go for More Information

Additional information about hospital administration and a list of colleges and universities offering such training may be obtained from:

American College of Hospital Administrators,  
840 North Lake Shore Dr., Chicago, Ill. 60611.

Association of University Programs in Hospital Administration,  
1642 East 56th St., Chicago, Ill. 60637.

Information on awards available from the U.S. Public Health Service for graduate training in hospital administration may be obtained from that agency's Division of Health Manpower Educational Services, Bureau of Health Manpower, 800 North Quincy St., Arlington, Va. 22203.

### LICENSED PRACTICAL NURSES

(D.O.T. 079.378)

#### Nature of Work

Licensed practical nurses assist in caring for medical and surgical patients, convalescents, handicapped people, and others who are physically or mentally ill. Under the direction of physicians and professional nurses, they provide nursing care which requires technical knowledge but not the professional training of a registered nurse. (See statement on Registered Professional Nurses.) In California and Texas, licensed practical nurses are known as *licensed vocational nurses*.

In hospitals, licensed practical nurses work with other medical personnel as members of the nursing team. They provide much of the bedside care needed by patients—for ex-



ample, taking and recording temperatures and blood pressures, changing dressings, administering certain prescribed medicines, and bathing bed patients and helping them in other ways with personal hygiene tasks. They may assist physicians and registered professional nurses in examining patients and in carrying out complex nursing procedures. They may

assist in the delivery, care, and feeding of infants. They may also help registered nurses in recovery rooms by watching for and reporting on any adverse changes in patients recovering from the effects of anesthesia. The duties of some licensed practical nurses include helping in the supervision of hospital attendants. (See statement on Hospital Attendants.)

Licensed practical nurses employed in private homes care mainly for patients whose day-to-day care seldom involves highly technical procedures or complicated equipment. In addition to providing the nursing care ordered by their patients' physicians, they may prepare patients' meals, keep their rooms tidy, and perform many other tasks essential to patients' comfort and morale. Teaching family members how to perform simple nursing tasks is another duty performed by many practical nurses working in private homes, as well as by those who are employed in public health agencies.

In doctors' offices and in clinics, licensed practical nurses help physicians by draping and positioning patients for examinations and treatments in much the same way as in hospitals. In addition, they may perform clerical tasks such as making appointments and recording addresses, ages, and other information about patients.

### Where Employed

About 300,000 licensed practical nurses were employed in 1966. The great majority were women.

About one-half of all licensed practical nurses were employed in hospitals. Most of the others worked in nursing homes, clinics, doctor's offices, sanitariums, and other long-term care facilities. Public health agencies and welfare and religious organizations also employed many licensed practical nurses. Some worked in the homes of their patients.

### Training, Other Qualifications, and Advancement

All States and the District of Columbia have laws which regulate the training and licensing of practical nurses. Usually, licenses are issued only to those candidates who have completed a course of instruction in practical nursing which has been

approved by the State board of nursing, and who have also passed a licensing examination.

Young people seeking to enroll in State-approved training programs must usually be at least 17 (or 18) years old and have completed at least 2 years of high school or its equivalent. Physical examinations are required and aptitude tests given. In some States, candidates may be accepted who have completed only the eighth or ninth grade, and, in still others, high school graduation is required. Many schools that do not require completion of high school nevertheless give preference to graduates.

In 1966, about 1,080 State-approved training programs provided instruction in practical nursing. More than one-half were offered by public schools as a part of vocational and adult education programs. Other programs were available at junior colleges, or were sponsored by local hospitals, health agencies, and private educational institutions and were usually 1 year in length. In some schools, tuition was free, and in others the charge generally ranged between \$150 and \$300.

The training offered includes both classroom study and clinical practice. Classroom instruction covers nursing concepts and principles and related subjects such as anatomy, physiology, medical-surgical nursing, nutrition, first aid, and community health. This work is supplemented by laboratory practice and by supervised work in hospitals where students apply their skills to actual nursing situations.

Among the personal qualities essential for practical nurses are a liking for people and a genuine desire to help them. Other attributes include mental alertness, patience, understanding, emotional stability, and dependability. Good health is extremely important.

Opportunities for advancement to more responsible or specialized positions are limited, unless workers take additional training. Thus, through in-service training, some practical

nurses may prepare themselves for work in specialized fields such as rehabilitation. Practical nurses cannot advance to positions as registered nurses, however, unless they undertake the years of additional schooling which are required.

### Employment Outlook

Licensed practical nurses are expected to be in strong demand during the years ahead. In spite of a rapid increase in employment in this occupation during recent years, the supply of qualified workers is still insufficient to fill all jobs. Employment is expected to continue to rise very rapidly through the 1970's, and a large number of new jobs will have to be filled each year as health facilities continue to expand. In addition, many workers will be needed annually to replace practical nurses who retire or stop working for other reasons. Many positions will be available for those wishing to work part time.

The need for more workers in this occupation has been due in large part to the greater utilization of licensed practical nurses for certain kinds of patient care which do not require the skills of a registered professional nurse. This use of practical nurses as members of hospital nursing teams is expected to continue to create many job opportunities. Other factors which will contribute to increased employment are a greater need for health services because of growth in the population and the increasing ability of persons to pay for health care, and the continuing expansion of both public and private health insurance plans.

### Earnings and Working Conditions

The salaries of licensed practical nurses employed in hospitals surveyed in mid-1966 ranged from an average of \$61.50 a week in the Southern States to \$81.50 in the West, according to a Bureau of Labor Sta-



tistics (BLS) survey. Nationwide, the average was \$72.50.

In many hospitals, practical nurses receive periodic pay increases after they have completed specified periods of satisfactory service. Some hospitals also provide free laundering of uniforms; less frequently, meals and uniforms are furnished without charge. In a few institutions, free lodging may be provided. The scheduled workweek is generally 40 hours but because nursing care must be provided around the clock, it often includes some work at night and on weekends and holidays. Provisions for paid holidays and vacations, and for health insurance and pension plans are common in many hospitals.

Licensed practical nurses employed full time in nongovernmental nursing homes and related facilities averaged weekly earnings of \$64 in early 1965 according to another BLS survey. In private homes, licensed practical nurses are usually on duty for 8, 10, or 12 hours a day and go home at night. A few, on 24-hour duty, live at the homes where they are employed. The earnings of those who are on duty only during the daytime hours are estimated at \$1.50 to \$2.50 an hour.

Salaries of licensed practical nurses employed by public health agencies averaged \$4,137 a year in 1966. The starting salaries for inexperienced licensed practical nurses employed by the Federal Government was \$4,269 in early 1967.

### Where To Go for More Information

Information about approved schools of practical nursing is available from State practical nursing associations and from the State board of nursing at each State capital. A list of State-approved training programs and information about the occupation of practical nurse may also be obtained from:

ANA-NLN Nursing Careers Program,  
American Nurses' Association,  
10 Columbus Circle, New York, N.Y.  
10019

National Association for Practical  
Nurse Education and Service, Inc.  
535 Fifth Ave., New York, N.Y.  
10017.

National Federation of Licensed Prac-  
tical Nurses, Inc.,  
250 West 57th St., New York, N.Y.  
10019.

Information about employment opportunities in United States Veterans Administration hospitals may be obtained from:

Department of Medicine and Sur-  
gery,  
Veterans Administration,  
Washington, D.C. 20420.

## MEDICAL LABORATORY ASSISTANTS

(D.O.T. 078.381)

### Nature of Work

Medical laboratory assistants perform routine laboratory work under the supervision of medical technologists and pathologists or other physicians. Using microscopes, centrifuges, spectrophotometers, and similar instruments, they perform laboratory tests to analyze body fluids for



Laboratory assistant prepares to examine blood smear.

various biological components and to aid medical technologists in determining the presence of cancer, tuberculosis, diabetes, meningitis, and other diseases. Assistants also prepare tissue samples, take blood samples, and prepare slides for microscopic study. In addition to performing routine laboratory tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Medical laboratory assistants employed in large laboratories may concentrate in one of the several areas of laboratory work: Bacteriology, serology, and parasitology; hematology; blood bank; clinical chemistry; urinalysis; or basal metabolism and electrocardiography. Laboratory assistants working in bacteriology, serology, and parasitology prepare and stain slides for study, apply sensitivity discs to culture plates and record results; and prepare specimens for microscopic studies. Those working in hematology collect and perform blood counts and perform tests to determine bleeding time, coagulation time, sedimentation rate, and prothrombin time. In the field of clinical chemistry, assistants perform chemical analysis on samples of body fluids to assist in the diagnosis and treatment of diseases. Assistants working in the blood bank carry out slide and test-tube procedures to identify blood groups and keep blood-bank records. They assist in such laboratory techniques as centrifuging urine samples, preparing the samples for microscopic study, and examining stained and unstained sediment. In basal metabolism and electrocardiography work, they prepare patients for tests as well as operate and maintain testing equipment. In small laboratories, medical laboratory assistants generally work in many areas. This occupation should not be confused with the medical technologist which requires 4 years of post-secondary training. (See statement on Medical Technologists.)

### Where Employed

An estimated 50,000 medical laboratory assistants were employed in 1966; about 80 percent were women. Hospital laboratories employed the largest number—nearly three-fourths of the total. Assistants were also employed in public and private clinical laboratories, physicians' offices, public health agencies, and industrial and pharmaceutical laboratories.

The Federal Government employed more than 2,900 medical laboratory assistants in 1966. Most of these assistants worked in veterans' hospitals, and the remainder were employed by the Armed Forces and the Public Health Service.

### Training, Other Qualifications, and Advancement

Most medical laboratory assistants employed in 1966 received their training on the job. In recent years, however, an increasing number have received their training in academic programs conducted by hospitals or by schools in cooperation with hospitals. In the future, academic training probably will be required by most employers.

Academic training programs for medical laboratory assistants are offered in special schools operated by hospitals, in vocational schools, and in junior colleges. Hospitals offer the greatest number of training programs, some of which were established recently under the Manpower Development and Training Act and the Vocational Education Act. For entry into these programs, graduation from high school with courses in science and mathematics is required generally. The programs last a year and include classroom instruction and practical training in the laboratory. These programs often begin with a general orientation to the clinical laboratory and are followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, urinalysis,

basal metabolism, and electrocardiography.

Medical laboratory assistant programs in junior colleges usually last about 2 years. Students spend the first 9 months in a liberal arts curriculum. During the next year they take courses in clinical laboratory procedures, including practical laboratory experience.

Young people interested in a career as a medical laboratory assistant should select a training program with considerable care. Information should be obtained about the length of time the training program has been in operation, instructional facilities, faculty qualifications, and the kinds of jobs obtained by graduates.

Assistants who continue their education and obtain a bachelor's degree in biology or chemistry, or a degree or certificate in medical technology can advance to medical technologist.

Personal characteristics considered desirable include good vision, manual dexterity, and the ability to work under pressure and to work well with others.

### Employment Outlook

Employment opportunities for medical laboratory assistants are expected to be excellent through the 1970's. Factors underlying an anticipated rapid growth in the occupation include the country's expanding population; increasing use of laboratory tests in routine physical checkups as well as in the diagnosis and treatment of disease; rising standards of living and health consciousness; expanding medical services resulting from new medical techniques and drugs; expanding medical research activities; and extension of prepayment programs for medical care, including Medicare.

Advances in technology are expected to stimulate the demand for workers in this occupation. Many new technological developments permit greater numbers and more varieties of tests to be performed. On the other hand, the development of new auto-

mated equipment that reduces the need for personnel to do simple repetitive tasks may tend to partially offset the growth in demand for the services of medical laboratory assistants.

In addition to assistants who will be needed to fill openings resulting from the rapid growth of the occupation, large numbers will also be needed as replacements. Each year many openings will arise because a large number of women will leave the field for marriage and family responsibilities. Opportunities also should be good for qualified older workers and handicapped persons.

### Earnings and Working Conditions

Average annual salaries for medical laboratory assistants ranged from \$3,600 to \$4,600 in 1966, according to limited data available. In general, laboratory assistants employed on the West Coast and in large cities received higher salaries. The Federal Government paid medical laboratory assistants starting salaries of \$4,269 a year in early 1967.

Laboratory assistants generally work a 40-hour week. In hospitals, they can expect some night or weekend duty. Hospitals generally provide vacation and sick leave benefits; some have retirement plans.

The laboratories in which assistants work are in general well lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist in laboratories if proper methods of sterilization and handling of specimens, materials, and equipment are used.

### Where To Go for More Information

Information about employment opportunities and educational requirements for medical laboratory assistants may be obtained from local hospitals and from:

Board of Certified Laboratory Assistants,  
445 North Lake Shore Dr., Chicago,  
Ill. 60611

## MEDICAL RECORD LIBRARIANS

(D.O.T. 100.388)

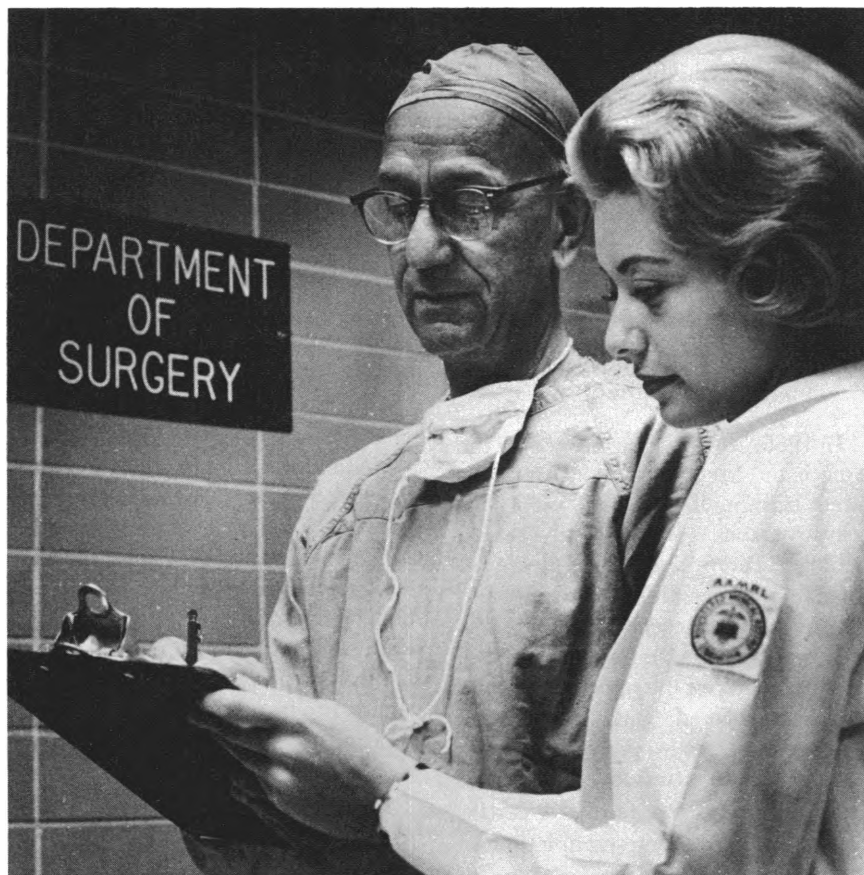
### Nature of Work

Medical record librarians plan, prepare, maintain, and analyze records and reports on patients' illnesses and treatments. They assist medical staff members in research projects; develop auxiliary records (such as indexes of physicians, diseases treated, and operations performed); compile statistics, especially those pertaining to services given patients; make summaries or "abstracts" of medical records; develop systems for documenting, storing and retrieving medical information; and direct the activities of the medical record department.

The size and type of institution employing medical record librarians

will affect the duties and amount of responsibility assigned to these workers. In large hospitals, chief medical record librarians supervise other medical record librarians, medical record technicians, and clerical workers. They usually represent their department at hospital staff meetings and may be called to testify in court actions involving medical records. In small hospitals, they may be the only employee in the medical record department and may perform clerical as well as professional duties.

Medical record librarians prepare records containing medical and surgical information on each patient, including case histories of illnesses, physical examination findings, doctors' orders and progress notes, nurses' notes, and reports on X-rays and laboratory findings. These records are used for research, insurance claims, legal actions, evaluation of



Medical record librarians work closely with other professional members of hospital staff.

treatment and medications prescribed, and for instruction in the training of medical, nursing, and related personnel. The medical information found in hospital records is also useful in planning community health centers and programs and in hospital and health care administration.

Medical record librarians should not be confused with the medical librarians who work chiefly with books, periodicals, and other publications. (See statement on Librarians.)

### Where Employed

About 12,000 medical record librarians were employed in 1966. Of these, about 3,800 were Registered Record Librarians, according to the American Association of Medical Record Librarians. In addition, about 25,000 other medical record personnel were working in this field. Most of the librarians were employed in hospitals; the remainder worked in clinics, medical research centers, the medical departments of insurance companies and industrial firms, and in local and State health departments. Although most medical record librarians are women, the number of men in the occupation is growing.

### Training, Other Qualifications, and Advancement

In 1966, 28 schools approved by the American Medical Association offered training in medical record library science or medical record administration. These schools are located in colleges and universities and in hospitals. The specialized academic training program, about 1 year in length, has about the same curriculum wherever offered, but prerequisites range from 2 to 4 years of college-level work, the latter now is preferred more and more frequently. A certificate is granted upon completion of the 1-year specialized training, except when it has been taken for credit as

part of a 4-year undergraduate program leading to a bachelor's degree in medical record science.

The specialized curriculum includes both theoretical instruction and practical experience. The required courses include anatomy, physiology, fundamentals of medical science, medical terminology, medical record science, ethics, management, hospital organization and administration, and data processing. Practical experience involves hospital admitting and discharging procedures; standard indexing and coding practices; compilation of statistical reports; analysis of medical data from clinical records; and knowledge of medical record systems for the X-ray, pathology, outpatient, and other hospital departments.

Graduates of approved schools in medical record science are eligible for the national registration examination, given by the American Association of Medical Record Librarians. Upon passing this examination, they receive professional recognition as Registered Record Librarians.

Medical record librarians must be accurate, interested in detail, and willing to persist in obtaining data. Because the information is of a confidential nature, they must be especially discreet in processing and releasing it. They should be able to maintain accuracy despite pressure, since the work is exacting and yet subject to frequent interruption. Those in administrative and supervisory positions must be able to work effectively with other hospital personnel.

Medical record librarians may advance to supervisory or administrative positions. They may serve as assistant chief or director of a single department or become the coordinator of medical record departments of several hospitals. Others may advance to faculty positions in collegiate or university programs for medical record librarians.

### Employment Outlook

Employment opportunities for medical record librarians are expected

to be excellent through the 1970's. In addition to the demand created by growth, many openings will occur because of the need to make replacements, which will probably be high as young women leave the field for marriage and family responsibilities. High school graduates will have many opportunities to become medical record technicians to assist librarians.

The increasing number of hospitals and the volume and complexity of hospital records will contribute to a growing demand for medical record librarians. Also, computers will be utilized increasingly to store and retrieve medical information; this should permit a greater use of medical records and, in turn, tend to increase the demand for medical record librarians. The importance of medical records will continue to grow rapidly, owing partly to the increased demand for clinical data necessary for research on diseases, the use of new drugs, and other methods of treatment. Special interest in the health care of the aged may necessitate recording data on the conditions of persons in nursing homes and home care programs. More consultants and group supervisors also will be needed to help standardize records in areas where medical record librarians are not available.

### Earnings and Working Conditions

The salaries of medical record librarians are influenced by the location, size, and type of employing agency, as well as by the duties and responsibility of the position held. Average weekly salaries ranged from \$100 to \$129.50, according to a survey of hospital employees in 21 metropolitan areas in mid-1966.

The average salary for chief medical record librarians (registered) in 1967 was \$7,000 a year, according to the American Association of Medical Record Librarians. Those with the bachelor's degree in medical record science from an approved school earned, on the average, about \$300 to \$500 more a year than graduates

of schools that did not offer such degrees.

Newly graduated medical record librarians employed by the Federal Government started at \$5,331 a year in early 1967. Annual salaries of experienced medical record librarians in the Federal Government generally ranged between \$6,500 and \$8,000.

Medical record librarians usually work a regular 40-hour week and receive paid holidays and vacations.

### Where To Go for More Information

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

The American Association of Medical Record Librarians,  
211 East Chicago Ave., Chicago, Ill.  
60611.

### MEDICAL TECHNOLOGISTS

(D.O.T. 078.281)

#### Nature of Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of disease. Medical technologists perform these tests under the direction of a pathologist (a physician who specializes in diagnosing the causes and nature of disease) or a scientist specializing in a clinical science.

The tests performed by medical technologists may include tests for blood count, blood cholesterol level, and skin tests. Other body fluid and tissue samples may be examined microscopically; cultured to determine the presence of bacteria, fungus, or other organisms; and analyzed for chemical content or reaction. Technologists type and cross-match blood samples; determine blood coagulation time and sedimentation rates; measure basal metabolism; and analyze water, food products, or other materials for bacteria. Medical technologists prepare slides from tissue



Medical technologist dilutes serum sample.

specimens for study of cellular structure.

Technologists who work in small laboratories often perform many types of tests. Those employed in large laboratories usually specialize in making several kinds of related tests in areas such as bacteriology, parasitology, biochemistry, microbiology, blood banking, hematology (the study of blood cells), histology (tissue preparation and examination), virology (the study of viruses), cytology (analysis of body cells), and nuclear med-

ical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests connected with the examination and treatment of patients. Some do research on new drugs or on the improvement of laboratory techniques; others teach or perform administrative duties.

The occupation of the medical technologist should not be confused with that of the medical technician or laboratory assistant. This statement does not include these workers, who

usually assist the medical technologist by performing simple, routine tests and related work that can be learned in a relatively short time. (See statement on Medical Laboratory Assistants.)

### Where Employed

About 40,000 medical technologists were employed in 1966—approximately 9 out of 10 were women. In recent years, however, the number of men in the field has been increasing. The great majority of all medical technologists work in hospitals; most of the others are employed by laboratories, public health agencies, research institutions, and pharmaceutical manufacturers.

The Federal Government is the largest single employer of medical technologists. In 1966, about 1,400 were employed in the hospitals and laboratories of the Veterans Administration, U.S. Public Health Service, and the Army, Navy, and Air Force.

### Training, Other Qualifications, and Advancement

The usual minimum educational requirement for beginning medical technologists is the completion of a specialized training program in medical technology. In 1966, such training was given in nearly 800 hospitals, of which over 600 were affiliated with colleges and universities. For entrance to programs accredited by the American Medical Association, the prospective technologist must complete 3 years of undergraduate work, including courses in chemistry, biological science, and mathematics. A few schools require a bachelor's degree for entry into the program. The training usually requires 12 months of study and includes extensive laboratory work. A bachelor's degree is often awarded upon completion of the college affiliated program. Sixteen universities also offer advanced degrees in medical technology for those who plan to special-

ize in teaching, administration, or research.

Graduates of AMA-accredited schools may take an examination to qualify for certification by the Registry of Medical Technologists of the American Society of Clinical Pathologists (ASCP). Technologists registered by the ASCP are preferred by many employers, especially in large hospitals and research laboratories. In the States of Alabama, California, Florida, and Hawaii, and in New York City, medical technologists also must be licensed.

Promotion may be to supervisory positions in certain areas of laboratory work or, after several years' experience, to the position of chief medical technologist in a large hospital. Graduate education, in one of the biological sciences or chemistry, may be required for advancement in research laboratories.

Personal characteristics important for medical laboratory work include accuracy, patience, dependability, and the ability to work under pressure. Manual dexterity and good eyesight (with or without glasses) are essential.

### Employment Outlook

Employment opportunities for medical technologists are expected to remain excellent through the 1970's. New graduates with a bachelor's degree in medical technology will be sought for entry positions in hospitals. A particularly strong demand is anticipated for technologists with graduate training in biochemistry, bacteriology, immunology, and virology.

Employment opportunities for medical technologists are expected to expand as physicians increasingly depend upon laboratory tests in routine physical checkups as well as in the diagnosis and treatment of disease. Also, the construction of additional hospital and medical facilities will increase the demand for these workers. Other factors affecting growth in this field are the increasing

complexity of laboratory work and expanding medical research. Newly developed automated equipment is not expected to limit the growth of medical technologists, as these machines require well-trained persons to operate them.

Replacement needs will continue to be high because many workers in this field are young women who may leave their jobs for marriage and family responsibilities. Many opportunities for part-time employment will continue to be available also.

### Earnings and Working Conditions

The average (median) annual salary for registered medical technologists was \$6,144 in 1966, according to a survey conducted by the National Committee for Careers in Medical Technology; those with graduate degrees had an average annual salary of \$7,828. Salaries varied by employer and location of employment.

Average weekly salaries of women medical technologists employed by private and non-Federal Government hospitals in metropolitan areas in mid-1966 ranged from \$97.50 in the South to \$130 in the West. Men usually received slightly higher salaries.

Newly graduated medical technologists employed by the Federal Government in early 1967 received a salary of \$5,331 a year. Most experienced technologists in Federal Government agencies earned annual salaries of between \$6,500 and \$8,500.

The average workweek of medical technologists is 40 hours, and they generally are covered by vacation and sick leave benefits; some are covered by retirement plans.

The laboratories in which medical technologists work are usually well-lighted and clean, although unpleasant odors and specimens of many kinds of diseased tissue are often present. Few hazards exist in the laboratories using proper methods of sterilization and handling of specimens,

materials, and equipment. If proper care is exercised, there is no danger of medical technologists being cut by laboratory instruments and glassware or burned by chemicals.

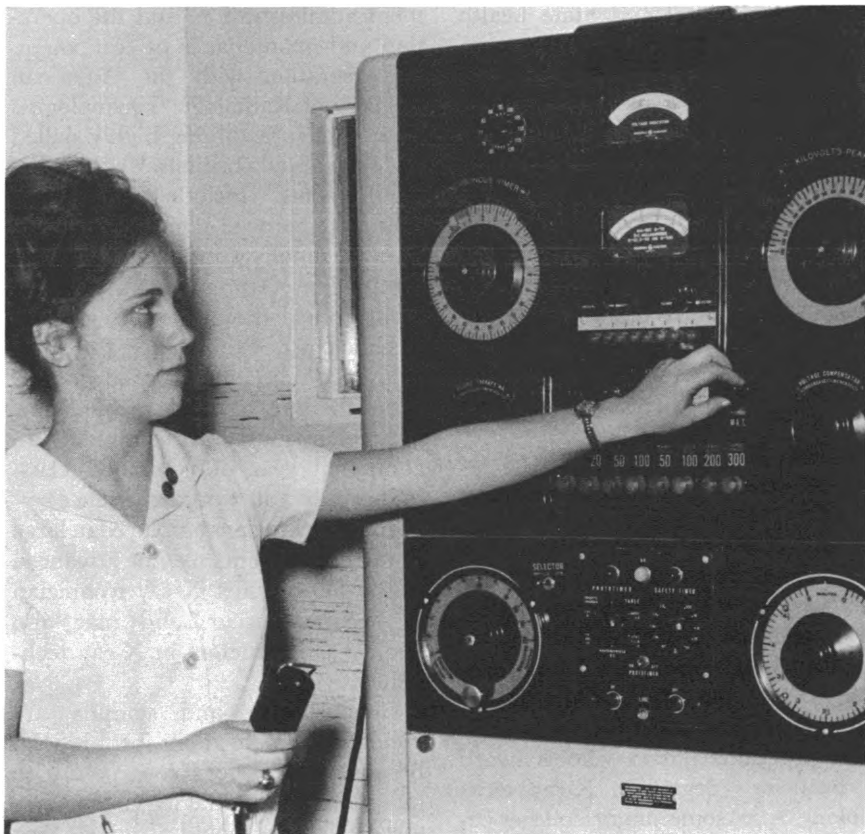
### Where To Go for More Information

Information about employment opportunities, as well as costs and entrance requirements of AMA-approved schools of medical technology, may be obtained from:

American Society of Medical Technologists,  
Suite 1600, Hermann Professional Bldg.,  
Houston, Tex. 77025.

Registry of Medical Technologists of the American Society of Clinical Pathologists,  
P.O. Box 2544, Muncie, Ind. 47302.

Information about employment opportunities in Veterans Administration hospitals may be obtained from the individual hospitals or the Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20421.



Technician determines proper voltage, current, and desired exposure time.

## MEDICAL X-RAY TECHNICIANS

(D.O.T. 078.368)

### Nature of Work

Medical X-rays play a major role in the diagnostic and therapeutic field of medicine. Medical X-ray technicians—also called radiologic technologists—operate X-ray equipment under the direction of physicians who are usually radiologists (specialists in the use of X-rays).

Most technicians perform diagnostic work, using X-ray equipment to take pictures of internal parts of the body which the doctor wishes to examine. They may prepare a prescribed X-ray "opaque," such as barium salts, which the patient swallows in order to shade various organs to provide proper visibility in the X-ray picture. To prepare patients for

X-ray, technicians position them between the X-ray tube and the film and cover body areas not to be exposed to the rays with a protective lead plate. When necessary, they set up or adjust devices to prevent the patient from moving. After determining the proper voltage, current, and desired exposure time, the technician operates the controls to obtain the pictures for interpretation by the physician. The technician may use mobile X-ray equipment at a patient's bedside and in surgery.

Some technicians perform therapeutic work. They regulate special radiation producing equipment used for treatment of diseases (for example, certain types of cancer). After placing the patient in the proper position, these technicians operate the equipment from an adjoining room. They may also assist the radiologist in measuring and handling radium and other radioactive materials.

Other technicians work in the relatively new field of nuclear medicine in which radioactive isotopes are used for diagnosing and treating diseases. Their duties in assisting the radiologist may include preparing and administering the prescribed radioisotope and operating special equipment for tracing and measuring radioactivity.

Medical X-ray technicians keep equipment in good working order by cleaning and making minor repairs. Other duties include processing film and keeping records of services performed for patients.

### Where Employed

About one-third of the estimated 72,000 X-ray technicians employed in 1966 worked in hospitals. Most of the remainder worked in medical laboratories, physicians' and dentists' offices

or clinics, Federal and State health agencies, and public school systems.

Most technicians work in or near large cities where medical facilities and services are concentrated. However, some are employed in hospitals and clinics in small towns or rural areas. A few work as members of small mobile X-ray teams, engaged mainly in tuberculosis detection.

About two-thirds of all X-ray technicians are women, although the number of men in the field has increased in recent years.

### **Training, Other Qualifications, and Advancement**

Training programs in X-ray technology are conducted by hospitals or by medical schools affiliated with hospitals. A program in X-ray technology usually takes 24 months to complete. A few schools offer 3- or 4-year programs and 11 schools award a bachelor's degree in X-ray technology. Also, some junior colleges coordinate academic training with work experience in hospitals in 3-year X-ray technician programs and offer an Associate of Arts degree. In 1966, more than 1,000 schools of X-ray technology were approved by the American Medical Association (AMA). In addition to training programs in approved schools, training also may be obtained in the military service. Some courses in X-ray technology are offered by vocational or technical schools.

All of the approved schools require that applicants be high school graduates, and a few require 1 or 2 years of college or graduation from a nursing school. High school courses in mathematics, physics, chemistry, biology, and typing are desirable. Preference is generally given to applicants between the ages of 18 and 30.

The program in X-ray technology usually includes courses in anatomy, physiology, nursing procedures, physics, radiation protection, darkroom chemistry, principles of radiographic exposure, X-ray therapy, radiographic positioning, medical ethics, depart-

ment administration, and the operation and maintenance of equipment.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an approved school of medical X-ray technology and the satisfactory completion of an examination. After registration, the title "Registered Technologist, R.T. (ARRT)" may be used. To become certified in radiation therapy or nuclear medicine, technicians must have completed an additional year of combined classroom study and work experience.

Some technicians employed in large X-ray departments may be advanced to the job of chief X-ray technician as openings occur, and may also qualify as instructors in X-ray techniques.

Good health and stamina are important qualifications for this field. Because of the possible exposure to radiation, people having a tendency toward anemia should avoid working with X-ray equipment, since they are relatively more susceptible to the adverse effects of X-rays.

### **Employment Outlook**

Employment opportunities for medical X-ray technicians are expected to be excellent through the 1970's. Despite an expected increase in the number of persons graduating from medical X-ray technology training programs, the demand for technologists is expected to be greater than the number of graduates available for employment.

The increasing use of X-ray equipment in the diagnosis and treatment of disease, and the continuing expansion of this use are the leading factors in the very rapid growth of employment opportunities. In addition, more workers will be needed to help administer radiotherapy, as new knowledge of the medical benefits of radioactive material becomes more widespread. Routine X-raying of large groups of

people will be extended as part of disease prevention and control programs. For example, many employers now demand that chest X-rays be taken of all employees, and most insurance companies include a chest X-ray as part of the physical examination required for an insurance policy.

In addition to the medical X-ray technologists needed for new jobs, replacement demands will probably be high because of the large number of women who leave their jobs each year for marriage or family responsibilities. For those who have left the field and want to return to work part time, opportunities should also be excellent through the 1970's.

### **Earnings and Working Conditions**

Average salaries of medical X-ray technicians ranged from \$85 a week in the South to \$106 in the West, according to a survey of all hospitals in mid-1966. The weekly salaries of chief X-ray technicians averaged about \$124. At all levels, men generally received higher average salaries than women.

New graduates of AMA-approved schools of X-ray technology or X-ray technicians with 1 year of general and 1 year of specialized experience were employed by the Federal Government at an annual salary of \$4,776 in early 1967. Most medical X-ray technicians working for the Federal Government earned between \$5,300 and \$6,500 a year.

Full-time technicians generally work 8 hours a day, 40 hours a week, but may be "on call" for some night or emergency duty. Most are covered by the same vacation and sick leave provisions as other workers in the same organization.

Care must be taken to protect medical X-ray technicians from the potential hazards of radiation exposure. Precautionary measures include the use of safety devices such as individual instruments that measure radiation, lead aprons, rubber gloves, and other shieldings.



### Where To Go for More Information

The American Society of Radiologic Technologists,  
537 South Main St., Fond du Lac,  
Wis. 54935.

The American Registry of Radiologic Technologists,  
2600 Wayzata Blvd., Minneapolis,  
Minn. 55405.

### OCCUPATIONAL THERAPISTS

(D.O.T. 079.128)

#### Nature of Work

Occupational therapists, guided by physicians, plan and direct educational, vocational, and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They work as members of a medical team which, in addition to physicians, may include physical therapists, vocational counselors, nurses, social workers, and other specialists.

The rehabilitation goals of the treatment prescribed for a patient may include regaining physical, mental, or emotional stability; combating boredom during a long-term illness; developing maximum self-sufficiency in the routine of daily living (such as eating, dressing, writing, and using a telephone); and, in the latter stage of treatment, performing jobs in a practical work situation for eventual return to employment.

As part of the treatment program, occupational therapists teach manual and creative skills such as weaving, clay modeling, and leather-working, as well as business and industrial skills such as typing, operating some business machines, and using power tools. Therapists may design and make special equipment or splints to aid some disabled patients in performing their activities. Other duties may include supervising student therapists, occupational therapy assistants, volunteer workers, and auxiliary nursing workers.

About one-third of the total number of occupational therapists work with emotionally handicapped patients, and the rest with persons having physical disabilities. These patients are of all ages, with varying diagnoses. The chief occupational therapist in a hospital may teach medical and nursing students the principles of occupational therapy. Many occupational therapists have administrative duties such as directing occupational therapy programs, coordinating patient activities, or acting as consultants to local and State

health departments and mental health authorities. Some occupational therapists are faculty members at colleges and universities offering programs in occupational therapy.

#### Where Employed

About 6,500 occupational therapists were employed in 1966. Although most occupational therapists are women, an increasing number of men have been entering the field in recent years.



Occupational therapist uses gardening activities to help emotionally disturbed patients.

More than three-fifths of all occupational therapists work in hospitals. Most of the remainder are employed in rehabilitation centers, homes for the aged, nursing homes, schools, out-patient clinics, and research centers. Some work in special workshops, sanitariums, camps for handicapped children, and in State health departments. Others are employed in home-visiting programs for patients unable to attend clinics or workshops. Still others are members of the Armed Forces.

### **Training, Other Qualifications, and Advancement**

The usual minimum requirement for entry into the profession is a degree or certificate in occupational therapy. In 1966, 31 colleges and universities in the United States offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. Nearly all of these schools offer 4-year programs to high school graduates. Several offer 2-year programs to students who have completed 2 years of college. About half of the schools also offer shorter programs leading to a certificate in occupational therapy for students with a bachelor's degree in another field.

The academic work in a 4-year program emphasizes the physical, biological, and behavioral sciences and the application of occupational therapy skills. In addition to the academic work, the training includes 6 to 9 months of supervised clinical experience in hospitals or health agencies. Some programs give part of the clinical experience during the summer or during part of the senior year. The Armed Forces offer programs whereby graduates of approved schools of occupational therapy, who meet the requirements to become commissioned officers, may receive the clinical part of their training while in the service.

Upon graduation and the completion of the clinical practice period, therapists are eligible to take the examination given by the American Occupational Therapy Association. Those who pass this examination may use the initials O.T.R. (Occupational Therapist Registered).

Five universities offer a program for occupational therapists leading to a master's degree in occupational therapy. A graduate degree is often required for teaching, research, or administrative work. The master's degree is also offered at three universities as the first professional degree for persons holding a baccalaureate degree in related fields.

Newly graduated occupational therapists generally begin as staff therapists. After several years on the job they may qualify as senior therapists. Experienced therapists may become directors of occupational therapy programs in large hospitals or clinics, or may become teachers. Some high-level positions such as program coordinators and consultants also are available in large institutions and agencies.

Personal qualifications needed in this profession include emotional stability, a sincere interest in helping people, and a sympathetic but objective approach to illness and disability. Manual dexterity, ingenuity, and imagination are needed also.

### **Employment Outlook**

Employment opportunities for occupational therapists are expected to be excellent through the 1970's. Despite anticipated increases in the number of graduates of occupational therapy programs, the demand for therapists is expected to exceed the supply as public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs increase. Many occupational therapists will be needed to staff the growing number of community health centers established under the Mental Retardation

Facilities and Community Mental Health Centers Construction Act of 1963, as amended. There will continue to be numerous opportunities for work with psychiatric patients, children, and aged persons, as well as with persons suffering from cerebral palsy, tuberculosis, and heart disease. In addition to openings that will result from growth, many openings will arise because of the need to replace the high proportion of young women who leave the field for marriage and family responsibilities.

Although hospitals and other employers prefer to hire registered occupational therapists, some opportunities will continue to be available for therapists who are not registered but have some of the required training and skills. Opportunities for experienced women who wish to return to work part time after rearing their children should be excellent.

### **Earnings and Working Conditions**

Average annual salaries of staff occupational therapists ranged from \$5,500 to \$10,000 in 1966, according to the limited data available. Directors of services, coordinators, consultants, and others in top administrative positions earned annual salaries up to \$14,000 in 1966.

In the Federal Government, the beginning annual salary for inexperienced occupational therapists was \$5,867 in early 1967. More than one-third of all occupational therapists in the Federal Government earned \$7,696 or more a year.

Most occupational therapists work an 8-hour day, 40-hour week, with some evening work required in a few organizations. Vacation leave usually ranges from 2 to 4 weeks a year, and many positions offer health and retirement benefits.

### **Where To Go for More Information**

American Occupational Therapy Association,  
251 Park Avenue South, New York,  
N.Y. 10010.

## OPTOMETRISTS

(D.O.T. 079.108)

### Nature of Work

Optometrists help people improve and protect their vision. They examine eyes, make tests to determine defects in vision, and, when needed, prescribe eyeglasses, contact lenses, corrective eye exercises, or other treatment that does not require drugs or surgery. Most optometrists supply their patients with the eyeglasses prescribed, and sometimes do minor repair work such as straightening eyeglass frames. Some optometrists specialize in work such as fitting partially sighted persons with telescopic spectacles, studying the relationship of vision to highway safety, and analyzing lighting and other conditions that affect the efficiency of workers in industry or business. A few are engaged primarily in teaching, research, or a combination of the two.

Optometrists should not be confused with ophthalmologists, sometimes referred to as oculists, or dispensing opticians. Ophthalmologists or oculists are physicians who specialize in the medical and surgical care of the eyes and may prescribe drugs or other treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on Dispensing Opticians.)

### Where Employed

Approximately 17,000 optometrists were employed in the United States in 1967. More than nine-tenths of all optometrists were self-employed. Of the remainder, most worked for established practitioners, health clinics, hospitals, optical instrument manufacturers, or government agencies. Some taught in colleges of optometry or served as optometrists in the Armed



Optometrist uses perimeter to examine patient's eyes.

Optometrists are located chiefly in large cities and industrial areas, where many people are engaged in office work or other occupations that tend to create or emphasize vision problems. About 40 percent of the total are found in five States—California, Illinois, New York, Pennsylvania, and Ohio. Many small towns and rural areas, especially in the South, have no optometrists.

### Training, Other Qualifications, and Advancement

A license is required to practice optometry in all States and the District of Columbia. Applicants for licenses must be graduates of an accredited school of optometry and pass a State board examination. In some States, only graduates of certain 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. There were 10 schools of optometry in the country in 1967. Applicants with the necessary qualifications have an excellent chance for admission to these schools. Needy students may obtain loans and scholarships up to \$2,500 a year to pursue full-time study leading to a degree in optometry from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

At least 6 years of college are needed to become an optometrist—2 years of preoptometry education in an approved college, followed by 4 years of training in an optometry school. Preoptometry courses include mathematics, physics, biology, and

chemistry, as well as English and other liberal arts courses. Students in schools of optometry have classroom and laboratory work and obtain professional experience in the out-patient clinics run by the schools. All schools award the degree of Doctor of Optometry (O.D.). Optometrists who wish to specialize often take graduate training. A master's or Ph. D. degree in physiological optics, or in a related field, is usually required for teaching and research work.

A prospective optometrist should have a liking for mathematical and scientific work, the ability to use delicate precision instruments, mechanical aptitude, and good vision. In addition, to become a successful practitioner, he must be able to deal with people tactfully.

Many beginning optometrists either set up a new practice or purchase an established one. Some start as salaried optometrists to obtain experience and the necessary funds to establish their own practice.

### Employment Outlook

Employment opportunities for new optometry graduates are expected to remain favorable through the 1970's. The demand for optometric services is expected to increase, but the total number of new graduates will probably be little more than the number needed to replace optometrists who retire, die, or stop practicing for other reasons.

Opportunities to set up a new practice will be best generally in small towns and in residential areas of cities, where the new optometrist can become known easily and where competition is not as keen as in large business centers. Communities, especially in the South, that have no optometric services available also will offer opportunities for new graduates. A good 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 in rela-

tion to the size, occupations, age, and income level of the population in the area.

Among the factors underlying the expected increase in demand for eye care services are a growing population with a larger proportion of older people and white collar workers, the groups most likely to need glasses; the wider recognition of the importance of good vision for efficiency at work and in school; and the greater acceptance of the use of eyeglasses and contact lenses to counteract eye strain and visual defects. Although 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.

### Earnings and Working Conditions

New optometry graduates who go into practice for themselves generally have a low income during the first few years. They usually earn less than new optometrists who take salaried positions. After a few years of experience, the situation is likely to be reversed, since the income of independent practitioners generally exceeds the earnings of salaried optometrists.

In early 1967, new optometry graduates in salaried positions generally started at about \$6,500 a year, according to the American Optometric Association. The average net income of experienced optometrists was about \$15,200. Incomes varied greatly, depending on location, specialization, and other factors.

Most optometrists work 40 to 49 hours per week regardless of whether they practice in a small town, medium-size city, or large city. 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,  
7000 Chippewa St., St. Louis, Mo.  
63119.

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, as well as licensing requirements.

## OSTEOPATHIC PHYSICIANS

(D.O.T. 071.108)

### Nature of Work

Osteopathic physicians diagnose, prescribe remedies, and treat diseases of the human body, paying particular attention to impairments in the musculo-skeletal system. They emphasize manual manipulative therapy, but in most States, they also use surgery, drugs, and all other accepted methods of medical care. Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and some city and county hospitals. A few doctors of osteopathy are engaged primarily in research, teaching, or writing and editing scientific books and journals. In recent years, there has been an increase in specialization. The specialties include: Internal medicine, neurology and psychiatry, ophthalmology and otorhinolaryngology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

### Where Employed

Nearly all of the 12,000 osteopathic physicians professionally active in the United States in early 1967 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 have osteopathic hospital facilities. In 1967, about half of all osteopathic physicians were in five States: Michigan, Pennsylvania, Missouri, Ohio, and Texas. Twenty-three States and the District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities having less than 50,000 people; specialists, however, practice mainly in large cities.

### Training and Other Qualifications

A license to practice as an osteopathic physician is required in all States. In early 1967, licensed osteopathic physicians were qualified to engage in all types of medical and surgical practice in 41 States and the District of Columbia. The remaining States limit in varying degrees the use of drugs or the type of surgery that can be performed by osteopathic physicians.

To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 22 States and the District of Columbia, the candidate must pass an examination in the basic sciences before he is eligible to take the professional examination; 28 States and the District of Columbia also require a period of internship after graduation from osteopathic school. All States except California and Florida grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

Although 3 years of preosteopathic college work is the minimum requirement for entry to schools of osteopathy, 4 years is often preferred. Osteopathic colleges require successful completion of 4 years of professional study for the degree of Doctor

of Osteopathy (D.O.). Preosteopathic education must include courses in chemistry, physics, biology, and English. During the first 2 years of professional training, emphasis is placed on basic sciences such as anatomy, physiology, pathology, and on the principles of osteopathy; the last 2 years are devoted largely to work with patients in hospitals and clinics.

After graduation, almost all doctors of osteopathy serve a 12-month internship at 1 of the 88 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.

The osteopathic physician's training is very costly because of the length of time it takes to earn the degree of Doctor of Osteopathy. However, the Health Professions Educational Assistance Act of 1963 as amended provides Federal funds for loans and scholarships of up to \$2,500 a year to help needy students pursue full-time study leading to the degree.

Every year, more young people apply for admission to the five approved schools of osteopathy than can be accepted. In selecting students, these colleges consider grades received in preprofessional education, scores on medical aptitude tests, and the amount of preosteopathic college work completed. In 1966, nearly nine-tenths of the students entering osteopathic colleges had bachelor's degrees. The applicant's desire to serve as an osteopathic physician, rather than as a doctor trained in other schools of medicine, is a very important qualification. The colleges also give considerable weight 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, the osteopathic physician should study carefully the professional and legal requirements of the State in which he plans to practice. The availability of osteopathic hospitals and clinical facilities should also be taken into account when choosing a location.

### Employment Outlook

Opportunities for osteopathic physicians are expected to be excellent through the 1970's. Greatest demand for their services will probably continue to be in States where osteopathy is a widely accepted method of treatment, such as Pennsylvania and a number of Midwestern States. Generally, 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 may encounter less competition and therefore establish his professional reputation more easily than in the centers of large cities.

The demand for the services of osteopathic physicians is expected to grow through the 1970's because of such factors as the anticipated population growth, the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid, and the trend toward higher standards of health care. Furthermore, there is a likelihood of greater public acceptance of osteopathy, liberalization of certain State restrictions on the use of drugs and surgery by osteopathic physicians, and the establishment of additional osteopathic hospitals.

Despite the expected growth in demand, the employment of osteopathic physicians is expected to increase only moderately because the number of new osteopathic physicians being trained is restricted by the limited capacity of osteopathic colleges. Approximately half of all graduates expected each year through the 1970's probably will be needed to replace osteopathic physicians who retire, die,

or leave the profession for other reasons; hence the number of new graduates will be barely sufficient to maintain the present ratio of osteopathic physicians to population. Although some expansion in osteopathic college facilities is anticipated because of recent Federal legislation, which provides Federal funds to assist in the construction of new teaching facilities for osteopathic physicians, no significant increase in graduates is expected through the 1970's.

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. Women students, however, represented only about 2 percent of the total enrollment in osteopathic colleges in 1966, although men and women are equally eligible for admission.

### Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by such factors as ability, experience, the income level of the community served, and geographic location. The average income above business expenses of general practitioners, in early 1967, ranged from \$16,000 to \$22,000, according to the limited data available. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 and 60 hours a week. Those in general practice work longer and more irregular hours than 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 East Ohio St., Chicago, Ill.  
60611.

## PHARMACISTS

(D.O.T. 074.181)

### Nature of Work

Pharmacists dispense drugs and medicines and provide information on their use to help protect people's health. They fill prescriptions ordered by physicians and other medical practitioners, and sell many medicines which can be obtained without prescriptions. Pharmacists must understand the composition and effects of drugs and be able to test them for purity and strength. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is only a small part of present-day pharmacists' work, since many drugs are now produced by manufacturers in the form used by the patient.

Many pharmacists in drugstores or community pharmacies have sales and managerial as well as professional duties. Besides dispensing drugs, these pharmacists may buy and sell other kinds of merchandise and hire and supervise salesclerks. Some pharmacists, however, operate prescription pharmacies which sell only drugs, medical supplies, and health accessories. Pharmacists in hospitals fill prescriptions and advise the medical staff on the selection and effects of drugs; they may also make sterile solutions, buy medical supplies, teach in schools of nursing, and perform administrative duties. Some pharmacists, employed as medical sales representatives or "detail men" by drug manufacturers and wholesalers, sell medicines to pharmacies and inform doctors, dentists, and nurses about new drugs. Others teach in colleges, perform research, supervise the manufacture of pharmaceuticals, develop

new drugs, edit or write articles for pharmaceutical journals, or do administrative work.

### Where Employed

Of more than 120,000 licensed pharmacists working in 1966, about 104,000 were in retail pharmacies. Of these retail pharmacists, approximately half owned their pharmacies alone or as members of a partnership, and the other half were salaried employees. Most of the remaining pharmacists were employed by pharmaceutical manufacturers and wholesalers, or worked for hospitals. Others were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Some served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for State and local government agencies.

Nearly every town has at least one drugstore with one pharmacist or more in attendance. Most pharmacists, however, are employed in or near cities and in those States which have the greatest populations.

### Training, Other Qualifications, and Advancement

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must be a graduate of an accredited pharmacy college, pass a State Board examination and, in most States, also have 1 year of practical experience or internship under the supervision of a registered pharmacist. In 1967, 28 States required that part or all of this experience be acquired after graduation. All States except California, Florida, and Hawaii grant a license without an examination to properly qualified pharmacists already licensed by another State.

In 1967, there were 74 accredited colleges of pharmacy. Some of these were not filled to capacity and qual-

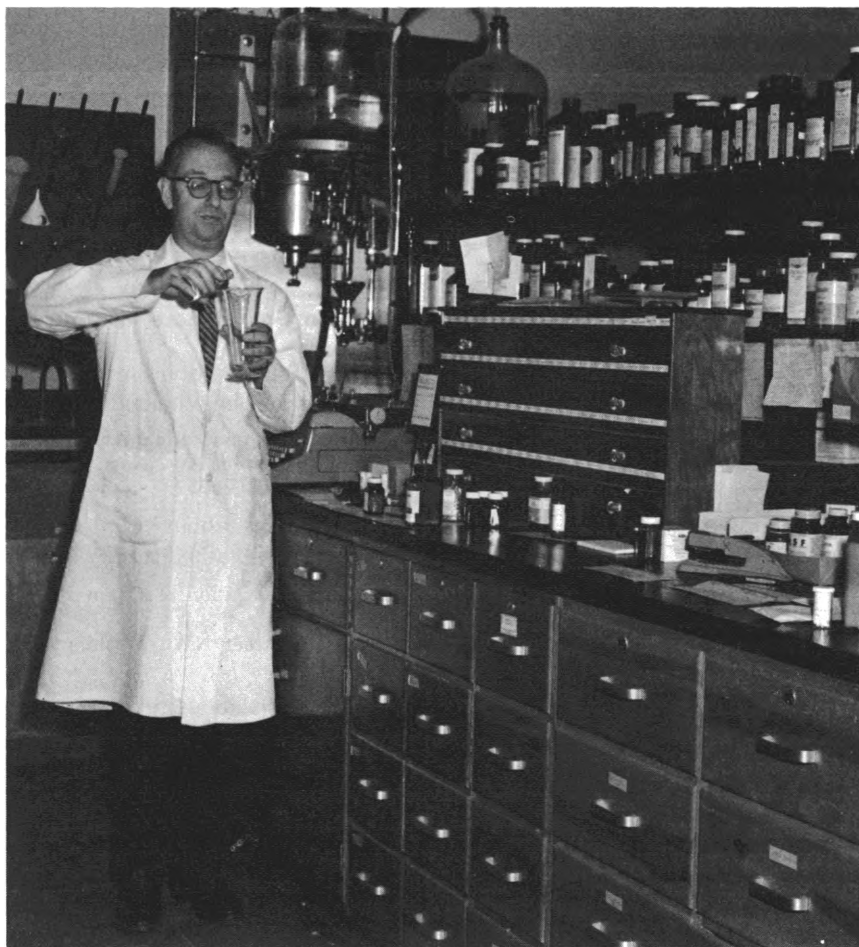
ified applicants could usually expect to be accepted. Needy students may obtain loans or scholarships up to \$2,500 a year to pursue full-time study leading to a degree in pharmacy from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

To graduate from a college of pharmacy, one must have at least 5 years of study beyond high school; two schools require 6 years. A few colleges admit students directly from high school and offer all the education necessary for graduation. Most provide 3 or 4 years of professional instruction and require all entrants to have completed their prepharmacy education in an accredited junior college, college, or university. A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry and biology, but also includes courses in the humanities and social science.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. However, the master's or doctor's degree in pharmacy or a related field—such as pharmaceutical chemistry, pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), or pharmacy administration—is usually required for research work or college teaching. Graduate study is desirable also 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 experience in a hospital pharmacy.

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

Pharmacists often begin as employees in community pharmacies.



Pharmacist compounds prescription.

After obtaining some experience and the necessary funds, they may become owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to managerial positions and, later, to a higher executive position within the company. Hospital pharmacists with the necessary training and experience may be advanced to chief pharmacist, or to other administrative positions.

### Employment Outlook

Most new pharmacy graduates will probably find employment readily through the 1970's. From 3,500 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 employment opportunities to absorb each year's graduates.

Some employment growth for pharmacists will result from the establishment of new pharmacies, particularly in residential areas or suburban shopping centers; the country's expanding population—especially the growing number of older people and children; and the rising standard of medical care. Many pharmacies may hire additional pharmacists because of a trend towards shorter working hours. Continued expansion in the manufacture of pharmaceutical products and in research are 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 with the construction of additional facilities and the more extensive use of pharmacists for hospital work. Pharmacists with graduate education will be needed for college teaching and laboratory research.

Women, who represent about 8 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 1967 they constituted about 14 percent of undergraduate enrollments.

### Earnings and Working Conditions

Beginning pharmacists employed in drug manufacturing firms could expect to receive salaries ranging from \$6,600 to \$7,800 a year in 1967, according to the limited information available. The entrance salary for newly graduated pharmacists in the Federal Civil Service was \$6,451 in early 1967; however, pharmacists with a year of experience could start at \$7,696.

The annual salaries of experienced pharmacists working for retail pharmacies were generally between \$8,000 and \$11,500. 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.

Retail pharmacists generally work more than the standard 40-hour workweek. Drugstores are often open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Despite the general trend toward shorter hours, 48 hours is still the basic workweek for many salaried retail pharmacists, and some work 50 hours or more 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. Salaried pharmacists usually receive paid vacations, health insurance, and other fringe benefits.

### Where To Go for More Information

General information on pharmacy as a career may be obtained from:

American Pharmaceutical Association,  
2215 Constitution Ave. NW., Wash-  
ington, D.C. 20037.

Information about chain drug stores may be obtained from:

National Association of Chain Drug  
Stores,  
1625 Eye Street NW., Washington,  
D.C. 20006.

Information about retail pharmacies may be obtained from:

National Association of Retail Drug-  
gists,  
1 East Wacker Dr., Chicago, Ill.  
60601.

A list of accredited colleges may be obtained from:

American Council on Pharmaceutical  
Education,  
77 West Washington St., Chicago,  
Ill. 60602.

Current requirements for licensure in a particular State may be obtained from the Board of Pharmacy of that State or from:

National Association of Boards of  
Pharmacy,  
77 West Washington St., Chicago, Ill.  
60602.

Information on college entrance requirements, curriculums, and scholarships is available from the dean of any college of pharmacy.

## PHYSICAL THERAPISTS

(D.O.T. 079.378)

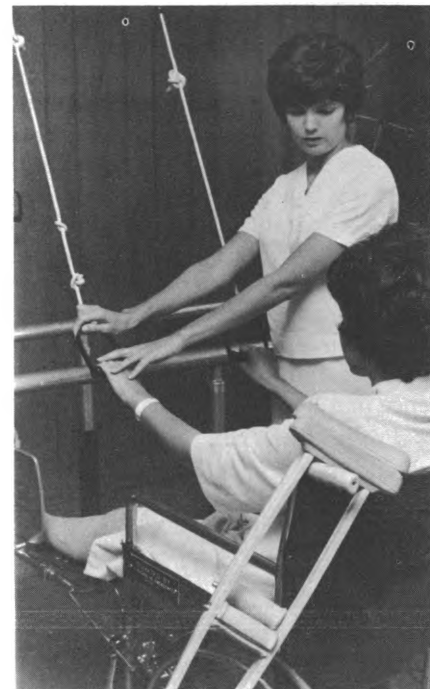
### Nature of Work

Physical therapists help persons with muscle, nerve, joint, and bone

diseases or injuries to overcome their disabilities. Following physicians' instructions, they treat patients through physical exercise, the use of mechanical apparatus, massage, and applications of heat or cold, light, water, or electricity. Most of their patients are accident victims, crippled children, and disabled older persons.

To obtain information needed to develop the proper programs for treatment, physical therapists perform muscle and nerve tests. They also keep records of their patients' progress during treatments and attend conferences with physicians and other medical personnel to discuss this progress. In many instances, they help disabled persons to accept their physical handicaps and learn how to adjust to them. Therapists teach patients how to perform exercises and to use and care for braces, crutches, and artificial limbs. They may also show members of the patients' families how to continue treatment at home.

Physical therapists are members of a rehabilitation team which is directed by a physician and may include a nurse, clinical social worker, occu-



Physical therapist instructs patient in use of arm exerciser.



pational therapist, psychologist, vocational counselor, and other specialists. Although qualified physical therapists may treat many types of patients, some specialize in caring for children, or for patients with amputations, arthritis, or paralysis. They may also instruct physical therapy students, as well as students of related professions and other health workers.

### Where Employed

Approximately 12,500 licensed physical therapists were employed in 1966. Nearly three-fourths of all therapists were women.

About four-fifths of all physical therapists work in general hospitals; in hospitals that specialize in the care of pediatric, orthopedic, psychiatric, or chronically ill patients; and in nursing homes.

Most of the remainder are employed by rehabilitation or treatment centers, schools or societies for crippled children, and public health agencies. Most of these organizations provide treatment for patients with chronic diseases, and some have home visiting programs.

Some therapists work in physicians' offices or clinics, teach in schools of physical therapy, or work for research organizations. Others serve as consultants in government and voluntary agencies.

### Training, Other Qualifications, and Advancement

A license is required to practice physical therapy in 48 States and the District of Columbia. To obtain a license, an applicant must have a degree or certificate from a school of physical therapy and pass a State board examination. In the remaining two States (Texas and Missouri), employers generally require a degree from an approved school of physical therapy. In 1966, 43 schools of physical therapy (including the Army Medical Service School) were approved by the American Medical

Association and the American Physical Therapy Association. The majority of approved schools are part of large universities; the others are operated by hospitals, which usually have university affiliations.

Most of the approved schools of physical therapy offer 4-year bachelor's degree programs. Some schools provide 1- to 2-year undergraduate programs to students who have completed some college courses through which students may earn either a degree or a certificate in physical therapy. Other schools accept those who already have a bachelor's degree and give a 12- to 16-month course leading to a certificate in physical therapy. Many schools offer both degree and certificate programs.

Among the courses included in a physical therapy program are anatomy, physiology, pathology, clinical medicine, psychology, electrotherapy, hydrotherapy, massage, and exercise. In addition to classroom instruction, students are assigned to a hospital or treatment center for supervised clinical experience in the care of patients.

Several universities offer the master's degree in physical therapy. A graduate degree, combined with clinical experience, increases the opportunities for advancement to positions of responsibility in teaching, research, and administration, as well as in the treatment area of physical therapy.

Because an important function of a therapist's job is to help patients and their families understand the treatments and prepare them emotionally for the changes that occur, therapists must have patience, tact, resourcefulness, and emotional stability. Their work also requires good verbal expression and the ability to plan their work to insure optimum use of time. In addition, physical therapists should have manual dexterity and physical stamina. For those who wish to determine whether they have the personal qualities needed for this occupation, summer or part-time work as a volunteer in the physical

therapy department of a hospital or clinic may prove helpful.

### Employment Outlook

Employment opportunities for physical therapists are expected to remain excellent through the 1970's. The demand for qualified workers is likely to continue to exceed the supply.

The demand for physical therapists is expected to increase very rapidly through the 1970's as the result of increased public recognition of the importance of rehabilitation. Many new positions for physical therapists are expected to be created as programs to aid crippled children and vocational rehabilitation activities are expanded to serve the increasing number of disabled people who require physical therapy. An expected rapid growth in nursing homes will also result in the need for many more physical therapists to work as staff members. Also, more physicians are expected to recommend physical therapy for patients as techniques and equipment for treatment are improved. In addition, many openings will continue to arise each year to replace the large number of women who leave the profession for marriage and family responsibilities.

Part-time positions will continue to be available in many communities. These positions are particularly attractive to married women who wish to return to work on a part-time basis.

### Earnings and Working Conditions

Annual salaries of inexperienced physical therapists averaged \$6,500 in 1966, and those of experienced therapists ranged from \$7,500 to \$15,000, according to the American Physical Therapy Association. Coordinators, directors, and administrators had average salaries of \$15,000 or more.

Average weekly salaries for physical therapists employed in hospitals ranged from \$120.50 in the Northeast

to \$134.50 in the West in mid-1966, according to a survey conducted by the Bureau of Labor Statistics. Salaries were generally higher for men in comparable jobs.

In early 1967, newly graduated therapists employed by the Federal Government received annual starting salaries of \$5,867; those graduating with high academic standing, however, were offered \$6,451. Physical therapists entering the Armed Forces are commissioned second lieutenants or ensigns, and those entering the U.S. Public Health Service are given the grade of junior assistant.

Most physical therapists work 40 hours a week. Almost all receive 2 weeks or more of vacation and the majority receive sick leave and other fringe benefits.

### Where To Go for More Information

American Physical Therapy Association,  
1740 Broadway, New York, N.Y.  
10019.

## PHYSICIANS

(D.O.T. 070.101 and .108)

### Nature of Work

Physicians diagnose diseases and treat people who are ill or in poor health. In addition, they are concerned with preventive medicine and with the rehabilitation of people who are injured or ill.

Physicians generally examine and treat patients in their own offices and in hospitals, but they also visit patients at home when necessary. Some physicians combine the practice of medicine with research or teaching in medical schools. 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.

More than one-third of the physicians engaged in private practice are general practitioners; the other two-thirds are specialists in 1 of the 35 fields recognized by the medical profession. In recent years, there has been a marked trend toward specialization. Among the largest specialties are internal medicine, surgery, obstetrics and gynecology, psychiatry, pediatrics, radiology, ophthalmology, and pathology.

### Where Employed

More than 280,000 physicians—of whom 7 percent were women—were professionally active in the United States in 1967. The great majority—about 180,000—were engaged in private practice. About 45,000 were interns or residents in hospitals. About 30,000 held full-time staff positions in hospitals, nearly three-fifths of whom were in government hospitals. The remainder were employed in private industry, State and local health departments, medical schools, research foundations, and professional organizations.

In 1967, more than 40 percent of all physicians were in the five most populous States: New York, California, Pennsylvania, Illinois, and Ohio. In general, the Northeastern States have the highest ratio of physicians to population and the Southern States, the lowest. General practitioners are much more widely distributed geographically than specialists, who tend to be concentrated in large cities.

### Training and Other Qualifications

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. As of 1966, 18 States permitted a physician to be licensed immediately after graduation from

medical school, but even in these States an internship is always necessary for full acceptance by the profession. Twenty-three States and the District of Columbia require candidates to 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 by 45 States and the District of Columbia as a substitute for State examinations. Although physicians licensed in one State can usually obtain a license to practice in another without further examination, some States limit this reciprocity.

In 1966, there were 88 approved schools in the United States in which students could begin the study of medicine. (By the end of the 1960 decade, several additional schools will be in operation.) Eighty-four awarded the degree of Doctor of Medicine (M.D.) to those completing the 4-year course; 3 offered 2-year programs in the basic sciences to students who could then transfer to regular medical schools for the last 2 years of study. The remaining school (set up as a 2-year institution) had not yet graduated its first class. Because the number of people applying to medical schools exceeds the beginning enrollment capacity, preference is given to the most highly qualified applicants.

Most medical schools require applicants to have completed at least 3 years of college education for admission to their regular programs, and some require 4 years. A few medical schools allow selected students with exceptional qualifications to begin their professional study after completion of 2 years of college. The great majority of students entering medical schools have a bachelor's degree.

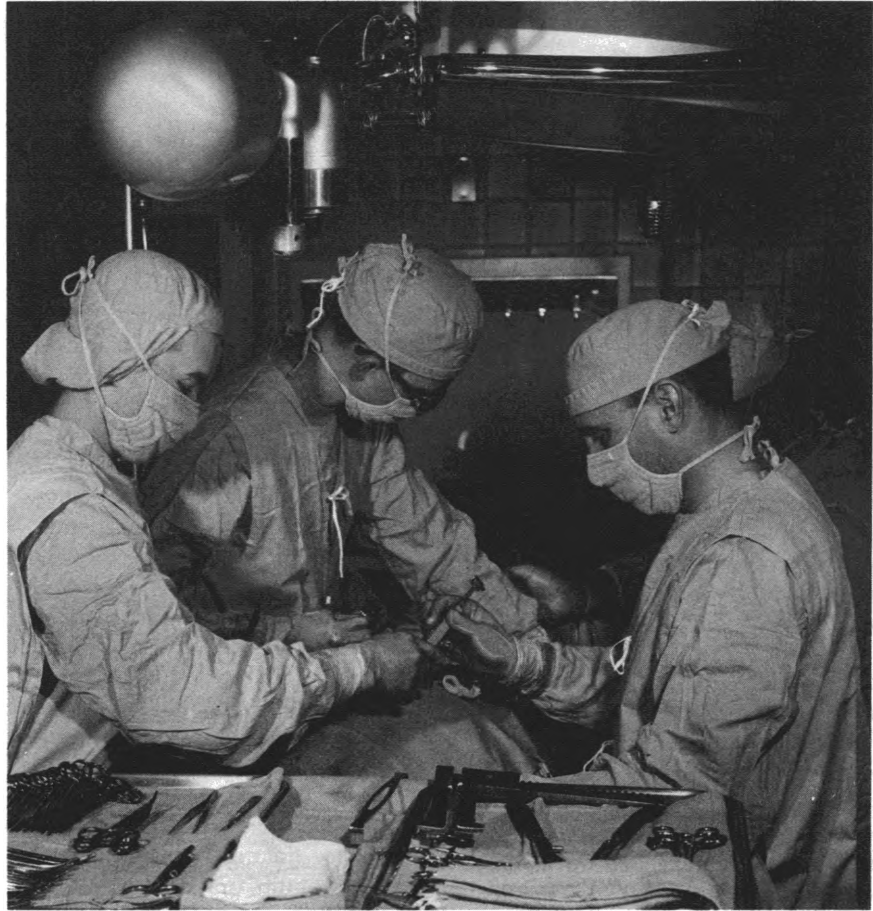
Premedical study must include undergraduate courses in English, physics, biology, and inorganic and organic chemistry in an accredited college. Students should acquire a broad general education by taking courses in the humanities, mathematics, and the

social sciences. Other factors considered by medical schools in selecting students include the individual's college record; the standing of the college where his premedical work was taken; and his scores on the Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. In addition, many State-supported medical schools give preference to residents of their particular States and, sometimes, those of nearby States.

The first 2 years of medical training are spent in laboratories and classrooms, learning basic medical sciences, such as anatomy, biochemistry, physiology, pharmacology, microbiology, and pathology. During the last 2 years, students spend most of their time in hospitals and clinics under the supervision of experienced physicians. They learn to take case histories, perform examinations, and recognize diseases.

New physicians increasingly are taking training beyond the 1-year hospital internship. Those who plan to be general practitioners often spend an additional year or two as interns or residents in a hospital. To become recognized as specialists, physicians must pass specialty board examinations. To qualify for these examinations, they must spend from 2 to 4 years—depending on the specialty—in advanced hospital training as residents, followed by 2 years or more of practice in the specialty. Some doctors interested in teaching and research take graduate work leading to the master's or Ph. D. degree in a field such as biochemistry or microbiology.

Many graduates of foreign medical schools (in September 1965, about 10,000 foreign citizens as well as approximately 1,300 U.S. citizens) serve as interns and residents in this country. To be appointed to approved internships or residencies in U.S. hos-



pitals, however, these graduates (citizens of foreign countries as well as U.S. citizens) must pass the American Medical Qualification Examination given by the Educational Council for Foreign Medical Graduates.

Medical training is very costly because of the long time required to earn the medical degree. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships of up to \$2,500 a year to help needy students pursue full-time study leading to the degree of doctor of medicine.

Among the personal qualifications needed for success in this profession are a strong desire to become a physician, above-average intelligence, and an interest in science. In addition, prospective physicians should possess good judgment, be able to make decisions in emergencies, and be emotionally stable.

The majority of newly qualified physicians open their own offices. Those who have completed their internships and who enter on active military duty serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of accredited medical schools are eligible for Federal Civil Service medical positions and for commissions as senior assistant surgeons in the U.S. public Health Service.

**Employment Outlook**

Excellent opportunities are anticipated for physicians through the 1970's. Because the number of new physicians being trained is restricted by the present limited capacity of medical schools, the employment of physicians is expected to grow only moderately, despite a steady increase in the demand for their services.

However, some expansion in medical school facilities is expected because of recent Federal legislation which provides Federal funds to assist in the construction of new training facilities for physicians. Nonetheless, any increase in the supply of physicians resulting from the implementation of this legislation may not be significant until the late 1970's.

The expected increase in demand for physicians' services will result from factors such as the anticipated population growth; the rising health consciousness of the public; and the trend toward higher standards of medical care. The demand for physicians will also increase because of the extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans; and the continuing growth in the fields of public health, rehabilitation, industrial medicine, and mental health. In addition, more physicians will be needed for medical research and to teach in medical schools.

In addition to those needed to fill new openings, many newly trained doctors will be required to replace those who retire or die. The number needed to fill vacancies caused by losses to the profession is estimated at about 6,000 each year through the 1970's.

To some extent, the rise in the demand for physicians' services will be offset by developments that are enabling physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are able to use their time more effectively by engaging in group practice. In addition, fewer house calls are being made by physicians because of the growing tendency to treat patients in hospitals and physicians' offices. However, these devel-

opments are not expected to offset the overall need for more physicians.

### Earnings and Working Conditions

New graduates serving as interns in 1966 had an average annual salary of \$3,578 in hospitals affiliated with medical schools and \$4,071 in other hospitals. Residents during 1966 earned average annual salaries of \$3,818 in hospitals affiliated with medical schools and \$4,059 in non-affiliated hospitals. Many hospitals also provided full or partial room, board, and other maintenance allowances to their interns and residents.

Graduates employed by the Federal Government early in 1967 could expect to receive an annual starting salary of about \$11,000 if they had completed their internship, and about \$13,000 if they had completed 1 year of residency or demonstrated superior achievement during their internship.

Newly qualified physicians who establish their own practice must make a sizable financial investment to open and equip a modern office. It is estimated that during the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay the expenses for maintaining their offices. As a rule, however, their earnings rise rapidly as their practice develops.

The net income of physicians in private practice was generally between \$20,000 and \$27,000 in 1966, according to the limited information available. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income level; and the physician's skill, personality, and professional reputation as well as his length of experience. Physicians engaged in private practice usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may not accept

new patients and tend to work fewer 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 medical schools, as well as general information on premedical education and medicine as a career, may be obtained from:

Council on Medical Education,  
American Medical Association,  
535 North Dearborn St., Chicago,  
Ill. 60610.

Association of American Medical  
Colleges,  
2530 Ridge Ave., Evanston, Ill.  
60201.

### PODIATRISTS

(D.O.T. 079.108)

### Nature of Work

Podiatrists (sometimes called *chiropodists*) diagnose and treat diseases and deformities of the feet. They perform foot surgery, use drugs and physical therapy, prescribe proper shoes, and fit corrective devices. To help in diagnoses, they take X-rays of the feet and perform blood and other tests. Among the conditions podiatrists treat are corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. They refer patients to medical doctors whenever they observe symptoms in the feet and legs that may be evidence of diseases—such as arthritis or heart or kidney trouble—which also affect other parts of the body.

As a rule, podiatrists provide most types of foot care. Some, however, confine their practice to such specialties as orthopedics (bone, muscle, and joint disorders), podopediatrics (children's diseases), or foot surgery.

A few act as consultants to shoe manufacturers, and a small number do research or teach in colleges of podiatry.

### Where Employed

Approximately 8,000 podiatrists were actively engaged in the profession in early 1967; less than 4 percent were women. Nearly all podiatrists were in private practice. The few who held full-time salaried positions worked mainly in hospitals or podiatry colleges, or for other podiatrists; others who earned salaries were employed by the Veterans Administration or were commissioned officers in the Armed Forces.

Podiatrists practice mainly in large cities. In early 1967, nearly half were in four of the most heavily populated States—New York, Pennsylvania, Illinois, and California. In many small towns and rural areas, especially in the South and the Northwest, there were no podiatrists.

### Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must be a graduate of an accredited 4-year program in a college of podiatry, and must pass a State board examination. In addition, three States—Michigan, New Jersey, and Rhode Island—require applicants to serve a 1-year internship in a hospital or clinic after graduation from a podiatry college; the State of Oklahoma requires 1 year of practice under the direct supervision of an experienced podiatrist. More than half the States grant licenses without further examination to podiatrists already licensed by another State.

The five podiatry colleges in the United States will admit only students who have already completed at least 2 years of college. This education must include courses in English, chemistry, biology or zoology, and, in

some instances, also physics or mathematics.

The first 2 years of podiatry training are devoted chiefly to classroom instruction and laboratory work in such basic sciences as anatomy, bacteriology, chemistry, pathology, and physiology, though in the second year students obtain some limited experience in the school clinics. During the final 2 years, students spend most of their time obtaining clinical experience. The degree of Doctor of Podiatry (D.P.) or Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience are generally necessary in order to qualify for work in a specialized area of podiatry. Needy students may obtain loans and scholarships up to \$2,500 a year to pursue full-time study leading to a degree in podiatry from Federal funds provided by the Health Professions

Educational Assistance Act of 1963, as amended.

Among the personal qualifications considered desirable for a career in this profession are scientific aptitude, manual dexterity, and a good business sense. The ability to get along well with people is also important.

Most newly licensed podiatrists open their own practices. Some purchase established practices. Others begin by taking salaried positions in hospitals, or with podiatrists already in practice, to gain experience and to save the money needed to establish their own practices.

### Employment Outlook

The employment outlook for podiatrists is expected to be good through the 1970's. Not only is the demand for their services expected to increase,



Podiatrist explains condition of child's foot.

but the number of new graduates of podiatry schools will probably be only slightly more than the number needed to fill openings left by podiatrists who retire, die, or stop practicing for other reasons.

Opportunities for new graduates to establish their own practices should be especially favorable in those parts of the country where the services of podiatrists are widely used. Opportunities should be good also for those who wish to enter salaried positions in schools, factories, and organizations providing health services.

The demand for podiatrists' services is expected to grow with the demand for other health services. An important factor underlying this anticipated growth is an expanding population with a greater proportion of older people—the age group needing most foot care. Furthermore, the trend toward providing preventive foot care for children is increasing.

### Earnings and Working Conditions

In podiatry, as in many of the other professions, incomes usually rise markedly after the first years of practice. Earnings of individual podiatrists are determined mainly by such factors as ability, experience, the income level of the community served, and location. In 1966, the average net income of podiatrists was about \$12,500, according to the limited information available. Income was generally higher in large cities.

Podiatrists generally work 40 hours a week. They may set their hours to suit their practice.

### Where To Go for More Information

Applicants for licenses to practice podiatry in a particular State may obtain information on the requirements for licensure from the State board of examiners in the State capital. Information on entrance requirements, curriculums, and scholarships is available from the colleges of podiatry. Additional information on podi-

atry as a career, as well as a list of colleges, may be obtained from:

American Podiatry Association,  
3301 16th St. NW., Washington,  
D.C. 20010.

## REGISTERED PROFESSIONAL NURSES

(D.O.T. 075.118 through .378)

### Nature of Work

Nursing care plays a major role in the treatment of persons who are ill. Registered professional nurses administer medications and treatments prescribed by physicians; observe, evaluate, and record symptoms, reactions, and progress of patients; assist in education and rehabilitation of patients and improve their physical and emotional environment; instruct auxiliary personnel or students; and perform other duties concerned with the care of the sick and injured, prevention of illness, and promotion of good health.

*Hospital nurses* are the largest group of registered nurses. Most of these are staff nurses, who perform skilled bedside nursing such as caring for a patient after an operation, assisting with blood transfusions and intravenous feedings, and giving medications. They also supervise auxiliary nursing workers. Some hospital nurses work primarily in the operating room. Others limit their work to certain types of patients such as children, the elderly, or the mentally ill. Still others are engaged primarily in administrative work.

*Private duty nurses* give individual nursing care to patients who need constant attention. In hospitals, one private duty nurse may sometimes take care of a few patients who require special nursing care but not full-time attention.

*Office nurses* assist physicians and dental surgeons, and occasionally dentists, in the care of patients in private practice or clinics. Sometimes,

they perform routine laboratory and office work.

*Public health nurses* care for patients in clinics or visit them in their homes. Their duties include teaching patients and families, and giving periodic nursing care as prescribed by a physician. They demonstrate diet plans to groups of patients, and arrange for immunizations. These nurses work with community leaders, teachers, parents, and physicians in community health education programs. Some public health nurses work in schools.

*Nurse educators* teach students the principles and skills of nursing, both in the classroom and at the bedside. They may also conduct refresher and in-service courses for registered nurses.

*Occupational health or industrial nurses* provide nursing care to employees in industry and government, and along with physicians are responsible for promoting employee health. They may work alone (with a doctor on call), or they may be part of a health service staff in a large organization. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They may also assist with health examinations and inoculations to help prevent or control diseases.

Nurses also engage in other activities such as research and serving on the staffs of nursing organizations. (Licensed practical nurses who also perform nursing service are discussed elsewhere in the *Handbook*.)

### Where Employed

More than 620,000 registered professional nurses were employed in the United States in early 1966. About two-thirds worked in public and private hospitals and related institutions. Approximately 65,000 were private duty nurses who cared for patients in hospitals and private homes, and

nearly 50,000 were office nurses. Public health nurses in government agencies, visiting nurse associations, and clinics numbered nearly 40,000; nurse educators in nursing schools accounted for about 23,000; and occupational health nurses in industry 18,000. Most of the others were staff members of professional nurse and other organizations, State boards of nursing, or were employed by research organizations.

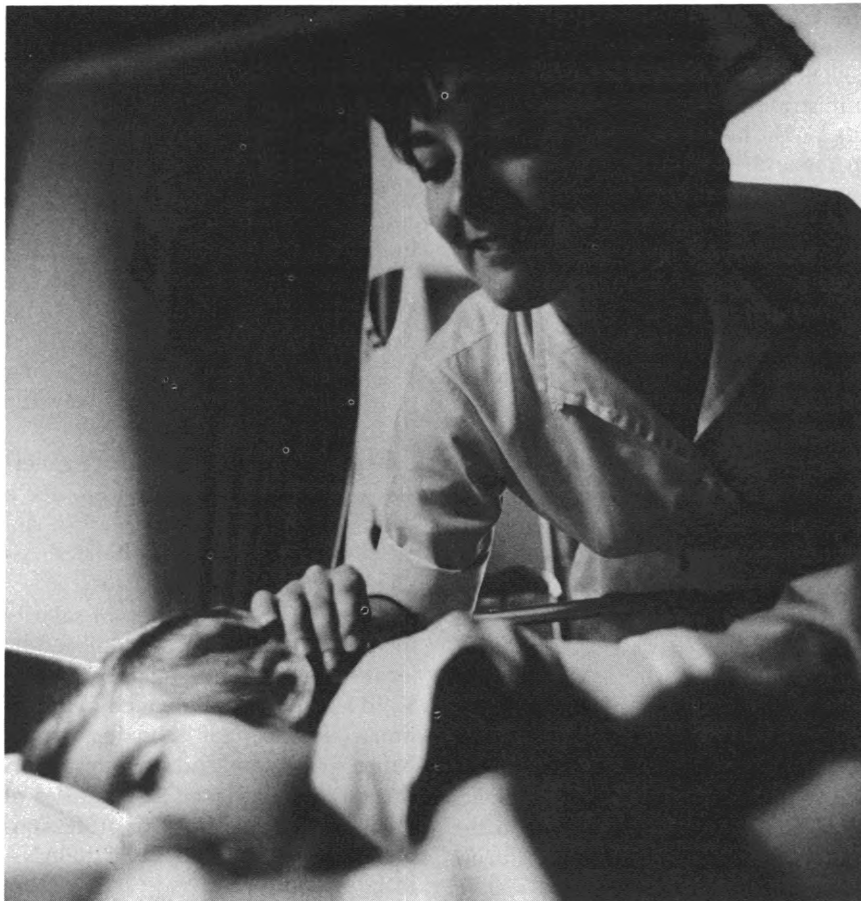
An estimated one-fourth of all nurses employed in 1966 worked on a part-time basis. About 1 percent of all employed professional nurses are men.

### Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To obtain a license, a nurse must have graduated from a school approved by a State board of nursing and pass a State board examination. A nurse may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Graduation from high school is required for admission to all schools of professional 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.

Three types of educational programs—diploma, baccalaureate degree and associate degree—offer the basic education required for careers in professional nursing. Diploma programs are conducted by hospital and independent schools and usually require 3 years of training; bachelor's degree programs usually require 4 years of study in a college or university, although a few require 5 years; associate degree programs in junior and community colleges require approximately 2 years of nursing education. In late 1966, more than 1,200 programs of these three types were offered in the United States. Diploma programs accounted for about two-thirds, the remainder being divided



evenly between associate and baccalaureate degree programs.

All programs include classroom instruction and supervised nursing practice. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. Under close supervision, they are given practical experience in the care of patients who have different types of illnesses, in hospitals and health facilities. Students in colleges offering bachelor's degree programs and in some of the other schools are assigned to public health agencies and learn how to care for patients in clinics and in the patients' homes. General education is combined with nursing education in baccalaureate and associate degree programs and in some diploma programs.

Young people considering a nursing career should have an interest in people and a desire to care for the sick and injured. Other desired personal

qualifications include dependability, good judgment, patience, and good physical and mental health.

Hospital nursing usually begins with staff positions from which experienced nurses may be advanced to progressively more responsible supervisory positions, such as head nurse, supervisor, assistant director, and director of nursing service. A master's degree, however, is often required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. In public health agencies, advancement opportunities are usually limited for nurses without degrees in public health nursing.

### Employment Outlook

Employment opportunities for registered professional nurses are expected to be very favorable through

the 1970's. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, public health nurses, and for work in research.

Among the principal factors underlying the anticipated rise in the demand for nurses is the country's rising population. Other factors include improved economic status of the population; extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; expansion of medical services as a result of new medical techniques and drugs; and increased interest in preventive medicine and rehabilitation of the handicapped. In addition to the number of nurses needed for new positions, several thousand nurses will be required to replace those who leave the field each year because of marriage and family responsibilities.

The anticipated rise in demand for registered nurses is expected to be accompanied by a rapid increase in the number of nurses graduating during the late 1960's and early 1970's. This growth is expected to result from increasing numbers of high school graduates who will enter nursing schools, and from the construction of additional nursing school facilities, in part from funds provided by the Health Facilities Act of 1963 and the Nurse Training Act of 1964. Moreover, under the Nurse Training Act, a needy student may obtain a loan, a portion of which does not have to be repaid if the student obtains full-time employment in nursing after graduation. The Nurse Training Act also provides funds to cover tuition, fees, and a stipend and allowances for trainees seeking advanced training for positions as administrators, supervisors, nursing specialists, and nurse educators. In addition to the anticipated increase in the number of new graduates entering nursing each year, an increase is also expected in the number of inactive nurses who will return to work.

### Earnings and Working Conditions

Average weekly salaries for registered professional nurses employed by hospitals ranged from \$100.50 for general duty nurses to \$154.00 for directors of nursing in mid-1966, according to a survey conducted by the Bureau of Labor Statistics (BLS). Salaries were generally highest in the West and lowest in the South. Salaries for industrial nurses averaged \$113 a week in early 1966, according to another survey conducted by the BLS.

Fees for private duty nurses generally were between \$14 and \$37 for a basic 8-hour day in early 1967, according to the American Nurses' Association (ANA).

Average (median) annual salaries for public health nurses employed by local government agencies were \$5,811 in 1966, as indicated by a National League for Nursing study. Nurse educators and administrators earned average (median) salaries of \$6,600 a year in schools of professional nursing when surveyed by the ANA in late 1965.

In early 1967, the Veterans Administration offered inexperienced nurses, who had either a diploma or an associate degree, an annual salary of \$5,867; and baccalaureate graduates were offered \$6,730. In other Federal Government agencies, the entrance rate for nurses was \$5,331 for graduates of associate programs who had 1 year of experience or additional nursing education. The beginning salary, in early 1967, for nurse officers (second lieutenants and ensigns) in military services was \$5,244 including allowances. Those with bachelor's degrees who were commissioned in the U.S. Public Health Service received salary and allowances totaling \$5,960 a year.

The majority of hospital nurses receive extra pay for work on evening or night shifts. Nearly all are provided at least 2 weeks of paid vacation after 1 year of service. Most hospital nurses receive from 5 to 13 paid holidays a

year and also some type of health and retirement benefits.

### Where To Go for More Information

Information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities may be obtained from:

ANA-NLN Nursing Careers Program,  
American Nurses' Association,  
10 Columbus Circle, New York, N.Y.  
10019.

Information about employment opportunities in the Veterans Administration is available from:

Department of Medicine and Surgery,  
Veterans Administration, Washington,  
D.C. 20420.

## SANITARIANS

(D.O.T. 079.118)

### Nature of Work

Most people assume that the food they eat, the liquids they drink, the public swimming pools they use, and the air they breathe are clean and safe. The job of the sanitarian is to insure this. They find and remove health hazards in order to make the physical environment safe for everyone. In carrying out their responsibilities, they perform a broad range of job duties, from inspecting sanitary conditions in restaurants to promoting health laws and administering environmental health programs.

Sanitarians entering the profession usually begin in public health or agriculture departments. They inspect hotels, restaurants, dairy plants, canneries, water supplies, medical care facilities, recreational areas, and other places to prevent conditions harmful to the public health and well-being, at times taking samples of food, air, and water, to test for safety. When necessary, they recommend corrective action in the places visited in accordance with health laws and



regulations. As they progress to more responsible investigational work, they frequently are required to give advice on more complex individual and industrial sanitation problems.

Sanitarians with supervisory duties analyze reports of inspections and investigations made by other environmental health specialists, evaluate their performance, and advise them on difficult or unusual sanitation problems. They conduct investigations and promote health laws, and may be required to give evidence in court against violators of health regulations. Also, they engage in health education activities, sometimes teaching classes in hygiene, and speaking before student assemblies, civic groups, and other organizations on the prevention of communicable diseases. Those in top supervisory positions are involved with the planning and administration of environmental health programs and their coordination with programs of other agencies. Other duties may include advising government officials on environmental health matters and drafting new health laws and regulations.

Public health sanitarians work closely with other health specialists in the community (such as the health officer, sanitary engineer, and public health nurse) to investigate and prevent outbreaks of disease, plan for civil defense and emergency disaster aid, make public health surveys, and conduct health education programs.

In large local and State health or agriculture departments, and in the Federal Government, sanitarians may specialize in a particular area of work, such as milk and other dairy products, food sanitation, refuse and other waste control, air pollution, occupational health, housing, and insect and rodent control. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

Increasing numbers of sanitarians are being employed outside government agencies. Many work in industry as food or milk sanitarians, where they prevent or minimize contamina-

tion hazards, and see that clean, healthful, and safe working conditions exist in plants manufacturing and processing food. For example, in a food processing plant, the sanitarian is concerned with the proper disposal of refuse; the cleaning of plant equipment; the control of micro-organisms; and the proper maintenance of buildings, equipment, and employee facilities.

### Where Employed

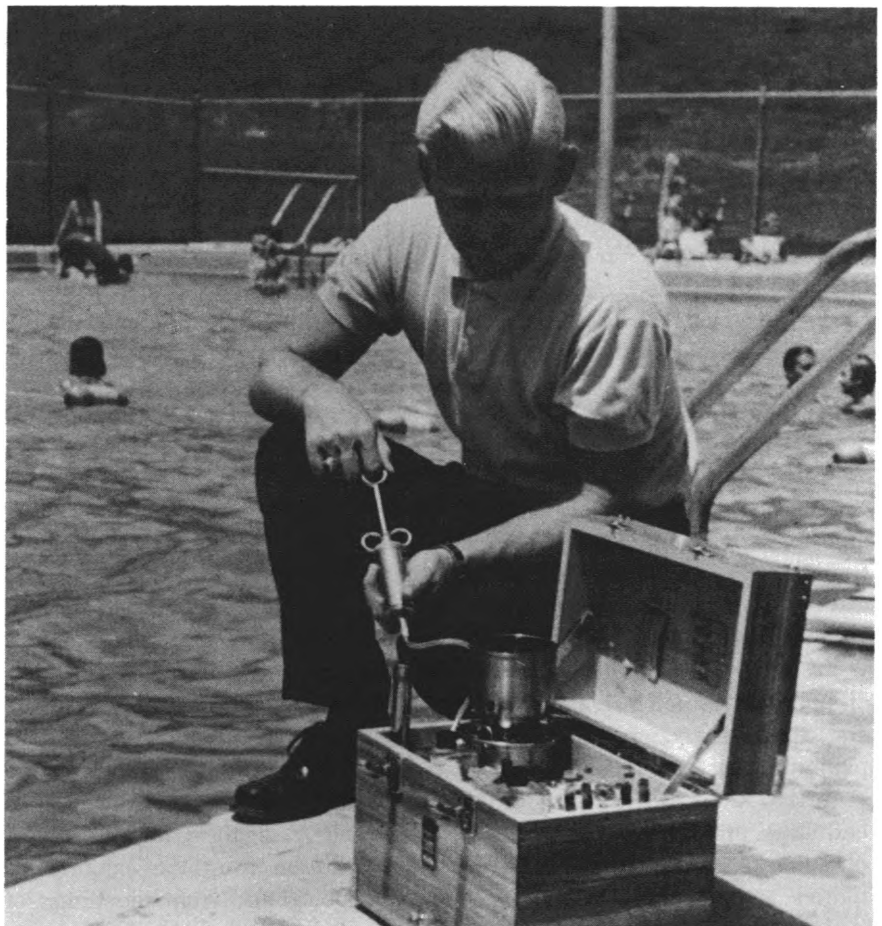
An estimated 13,000 of the approximately 16,000 sanitarians employed in 1966 worked for Federal, State, and local governments. Most of the remainder worked for manufacturers and processors of food products; a small number were teachers in colleges and universities; a few were

consultants; others worked for trade associations, in hospitals, or for other organizations. Probably less than 1 percent of all sanitarians are women.

Sanitarians are employed by government health departments in every State, and by private industry in most States. About half of them work in 10 States: California, Florida, Illinois, Indiana, New York, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin.

### Training, Other Qualifications, and Advancement

A 4-year college education with a major in physical, biological, or sanitary science is generally required for a beginning job as a sanitarian; a graduate degree in some aspect of public health is usually necessary for



Sanitarian tests pool water for bacteria.

higher level positions. Some health departments may hire beginning sanitarians with only 2 years of college work, and, in some, high school graduates may be able to start as sanitary inspectors and work their way up to sanitarian. However, rising hiring standards in public health departments are restricting entrance opportunities for those without degrees.

Science courses recommended by the American Public Health Association for the first 2 years of college are mathematics, biology, chemistry, physics, and elementary bacteriology. In the second 2 years, the recommended program includes advanced general bacteriology, medical entomology, and a series of public health courses. Liberal arts courses are also considered useful.

Beginning sanitarians usually start at the trainee level, where they remain up to a year, working under the supervision of experienced sanitarians. They receive on-the-job training in environmental health activities and learn to evaluate facts and recommend corrective action. After a few years of experience, they may move to minor supervisory positions with more responsibilities. Greater supervisory responsibilities may come with more experience; sometimes specialization begins at this level, especially in large local health offices. With more experience, further advancement is possible to top supervisory and administrative positions.

To keep up with new developments and to supplement their academic training, many sanitarians take specialized short-term training courses in such subjects as occupational health, water supply and pollution control, air pollution, radiological health, milk and food protection, metropolitan planning, and hospital sanitation.

In 1967, there were 31 States which had laws providing for registration of sanitarians; most of these States required registration to practice. Although requirements for registration vary considerably among the States,

the minimum educational requirement for registration is usually a bachelor's degree, with emphasis on the biological, physical, and sanitary sciences. In some States, applicants must pass a written as well as an oral examination.

Among the personal qualities useful to sanitarians is the ability to get along well with people. For example, it is often necessary to be tactful in securing correction of unsanitary conditions. Sanitarians also should be undisturbed by the collection of specimens for laboratory testing and contact with unpleasant physical surroundings, such as slum area housing or sewage disposal units.

### Employment Outlook

Employment opportunities for sanitarians are expected to be very favorable through the 1970's. Young people without a college degree with a major in one of the physical or biological sciences or in sanitary science will find that obtaining work in the sanitation fields is increasingly difficult.

Employment of sanitarians is expected to increase rapidly through the 1970's, as State and local health agencies expand their activities in the field of environmental health. Radiological health, occupational health, food protection, water pollution, and air pollution are expected to require the services of more trained personnel as health dangers grow under the stimulus of an expanding, highly technological civilization.

Air pollution is one example of an existing environmental hazard of public concern that is expected to increase the demand for sanitarians. It has attracted attention throughout the United States, especially in large cities where smog has become a problem. The discomfort and danger of air pollution from the exhausts of automobiles and from the fumes of industrial plants and other sources have been recognized in legislation at

all levels of government. The possible relation of respiratory ailments to air pollution has also served to focus attention on this problem.

The expanding population is yet another factor that will intensify the demand for more trained sanitarians. The migration of people from rural to urban areas, along with the growth of industries, will place a greater strain on the food-service, housing, water, recreational, and waste-disposal facilities of urban communities. Some increase in demand for sanitarians is expected in private industry, primarily in the food industry.

### Earnings and Working Conditions

In early 1967, the average (median) annual salary of sanitarians having college degrees was \$7,500 and about \$5,900 for those without a college degree, according to the National Association of Sanitarians. Annual salaries of sanitarians engaged in teaching averaged nearly \$10,500, compared with \$10,000 for those employed in industry. Those employed by the Federal Government averaged about \$8,700 a year.

Sanitarians spend considerable time away from their desks. Transportation or gasoline allowances are frequently given and some health departments provide an automobile.

### Where To Go for More Information

Information about careers as sanitarians is available from the following associations:

American Public Health Association,  
1790 Broadway, New York, N.Y.  
10019.

International Association of Milk,  
Food, and Environmental Sani-  
tarians,  
Blue Ridge Rd., P.O. Box 437,  
Shelbyville, Ind. 46176.

National Association of Sanitarians,  
1550 Lincoln St., Denver, Colo.  
80203.

## SPEECH PATHOLOGISTS AND AUDIOLOGISTS

(D.O.T. 079.108)

### Nature of Work

The inability to speak or hear clearly is a severe hardship to persons of all ages. Children who have difficulty speaking or hearing are usually unable to play freely with others or to participate fully in normal classroom activities. Adults suffering from speech or hearing impairments often face problems of job adjustment. Speech pathologists and audiologists help people suffering from such disorders by diagnosing their problems and by providing treatment. In addition, they may conduct research in the speech and hearing field. Some conduct training programs in speech pathology and audiology at colleges and universities.

Speech pathologists are concerned primarily with speech disorders and audiologists with hearing problems. Speech and hearing are so interrelated that, to be competent in either of these occupations one must have a familiarity with both. The speech pathologist works with children and adults who have such problems as stuttering, defective articulation, brain injury, foreign dialect, cleft-palate, mental retardation, or emotional problems which are reflected in speech and voice disorders. The audiologist also works with children and adults, but he concerns himself primarily with the assessment and treatment of hearing problems such as those caused by certain otological or neurological disturbances.

The duties performed by speech pathologists and audiologists vary with their education, experience, and employment setting. In a clinical capacity, they identify and evaluate speech and hearing disorders using various diagnostic procedures. This is followed by an organized program of therapy, with the cooperation of other specialists, such as physicians,



psychologists, social workers, physical therapists, counselors, and teachers. Some perform research work, which may consist of investigating communicative disorders and their causes and improving methods for clinical services.

Speech pathologists and audiologists working in colleges or universities provide instruction in the principles and bases of communication and clinical techniques. Many also participate in educational programs for physicians, nurses, teachers, and other professional personnel. In addition, they may work in university clinics and conduct research, usually at university centers.

### Where Employed

Approximately 17,000 persons were employed as speech pathologists and audiologists in 1966. Women represented a large proportion of this employment. The majority of speech pathologists and audiologists work in public school systems and clinical service centers. Colleges and universities employ the next largest number

of these specialists in classrooms and clinics. The remainder are distributed among hospitals, research centers, State and Federal Government agencies, industry, and private practice. Speech pathologists and audiologists are employed in all States; however, they are concentrated in States with large populations.

### Training and Other Qualifications

Most States require a master's degree in speech pathology or audiology or its equivalency for a beginning job as a speech pathologist or audiologist. In other States, the bachelor's degree is required for entry positions.

Undergraduate training in speech and audiology should include course work in anatomy, biology, physiology, physics, semantics, phonetics, and related areas. Some specialized course work in speech and hearing, as well as in child psychology and mental hygiene, also is helpful. This training is usually available at colleges and universities offering a broad liberal arts program.

Graduate education in speech and audiology is offered at 180 colleges and universities. Professional preparation at the graduate level involves extensive training in the fundamental areas of speech and hearing, including anatomy and physiology, acoustics, and psychological aspects of communication; the nature of speech and hearing disorders; and the assessment, evaluation, and analysis of speech production, language abilities, and auditory processes; as well as familiarity with various research methods used in studying speech and hearing. Persons who wish to work in public schools should complete not only the education and other requirements necessary for a teacher's certificate in the State in which they wish to work, but also may have to fulfill special requirements, prescribed by some States, for people who are going to work with handicapped children.

Many scholarships, fellowships, assistantships, and traineeships are available in colleges and universities; however, most of these are at the graduate level. The U.S. Vocational Rehabilitation Administration, the Children's Bureau, the U.S. Office of Education, and the National Institutes of Health allocate funds for teaching and training grants to colleges and universities offering graduate study in the field of speech and hearing. The Veterans Administration provides funds for a predoctoral program, during which the students receive monthly payments.

Speech pathologists and audiologists should have an interest and liking for people, and the ability to approach problems with objectivity. To work effectively with persons having speech and hearing disorders, one must be sensitive, patient, and have personal warmth and emotional stability.

### Employment Outlook

Employment opportunities for well-qualified speech pathologists and audiologists are expected to be good

through the 1970's. Individuals who have completed graduate study in speech pathology and audiology will have the best employment opportunities. Some opportunities will be available for individuals having only the bachelor's degree and some professional experience, but increasing emphasis is being placed on the master's degree as the minimum educational standard for the profession.

Many speech pathologists and audiologists will be needed annually through the 1970's to staff new and expanding programs in schools, clinics, colleges and universities, and hospitals and to replace those who die, retire, or leave the profession for other reasons. In recent years the number of persons completing graduate study has fallen short of the demand, and this pattern is expected to continue over the 1970's. Thus, qualified persons will continue to have many opportunities to enter these fields.

Several factors are expected to increase demand for the services of speech pathologists and audiologists during the 1970's: Population growth, which will result in an increase in the absolute number of persons having speech and hearing problems; a lengthening life span, which will increase the number of persons having speech and hearing problems that are common to later life; a rapid expansion in expenditures for medical research; the growing public interest and awareness of the serious problems connected with speech and hearing disorders, as illustrated by expanded Federal programs such as Medicare, Medicaid, and the 1966 Title VI Amendment to the Elementary and Secondary Education Act of 1965, which provides for the education of handicapped children.

### Earnings and Working Conditions

Median earnings of speech pathologists and audiologists in colleges and universities ranged from \$6,900 in private institutions to \$9,000 in State universities for a 9- to 10-month

contract period in 1966, according to limited data available. Median salaries may be as much as \$3,000 higher for an 11- to 12-month contract. Many experienced speech pathologists and audiologists in educational institutions supplement their regular salaries by incomes from consulting, special research projects, and writing books and articles.

In early 1967, the annual starting salary for speech pathologists and audiologists employed by the Federal Government was \$7,696. Applicants for positions with the Federal Government must have completed all requirements for the master's degree.

Most speech pathologists and audiologists work 40 hours a week; however, personnel engaged in research may work longer hours. Almost all employment situations provide fringe benefits such as paid vacations, sick leave, and retirement programs.

### Where To Go for More Information

Information on certification requirements for persons wishing to work in public schools can be obtained from the State department of education at the State capital.

General career information and a list of colleges and universities that have received grants to provide traineeships at the graduate level may be obtained from:

American Speech and Hearing Association,  
9030 Old Georgetown Rd., Washington, D.C. 20014.

### VETERINARIANS

(D.O.T. 073.081 through .281)

#### Nature of Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control numerous diseases and injuries among many species of animals. Their work is important for the Nation's food production and for public health. Veterinarians perform sur-

gery on sick and injured animals, and prescribe and administer drugs, medicines, serums, and vaccines. Their work helps to prevent the outbreak and spread of diseases among animals. Because many animal diseases can be transmitted to human beings, this aspect of their work is vital to the public health.

Veterinarians treat animals in veterinary hospitals and clinics, or on the farm and ranch. In addition, veterinarians give advice on the care and breeding of animals.

The majority of veterinarians are general practitioners. Of those who are specialists, the greatest number treat small animals or pets. Some specialize in the health care of cattle, poultry, or horses. Many veterinarians inspect meat, poultry, and other foods as a part of the Federal and State public health programs. Others are on the faculties of veterinary colleges. Some veterinarians do research related to animal diseases, foods, and drugs; other veterinarians, as part of a medical research team, seek knowledge about the prevention and treatment of human disease.

### Where Employed

About 24,000 veterinarians were working in 1967; only 2 percent were women. More than two-thirds of all veterinarians were in private practice. The Federal Government employed about 2,600 veterinarians, chiefly in the U.S. Department of Agriculture; some worked for the U.S. Public Health Service. About 1,000 veterinarians were commissioned officers in the Veterinary Corps of the Army and the Air Force. In addition, many worked for State and local government agencies and a few worked for international health agencies. Some were also employed by colleges of veterinary medicine, agricultural colleges, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies manufacturing drugs for animals.

In 1967, more than one-third of all veterinarians in the United States were in six States—California, New York, Illinois, Texas, Iowa, and Ohio. Veterinarians in rural areas chiefly treat farm animals; those in small towns usually engage in general practice; those in cities and suburban areas frequently limit their practice to pets.

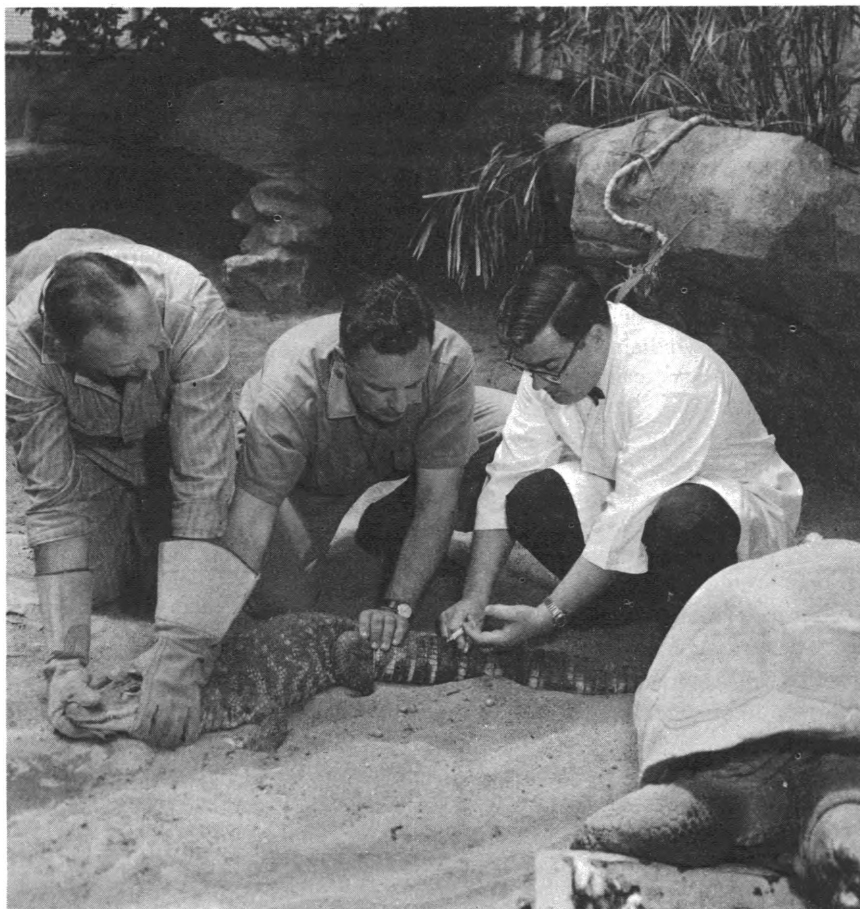
### Training, Other Qualifications, and Advancement

A license is required to practice veterinary medicine in all States and the District of Columbia. To obtain a license, an applicant must have the degree of Doctor of Veterinary Medicine (D.V.M.), awarded upon graduation from a veterinary school approved by the American Veterinary Medical Association; pass

a State Board examination; and, in a few States, have some practical experience under the supervision of a licensed veterinarian. A limited number of States issue licenses without further examination to veterinarians already licensed by another State.

For positions in research or teaching, the master's or Ph. D. degree in a field such as pathology, physiology, or bacteriology is usually required, in addition to the D.V.M. degree.

The minimum requirements for the D.V.M. degree are 2 years of pre-veterinary college work followed by 4 years of professional study in a college of veterinary medicine. However, most candidates complete 3 or 4 years of a preveterinary curriculum which emphasizes the physical and biological sciences. The veterinary college training includes considerable practical experience in diagnosing and



Zoo veterinarian treats ailing alligator.

treating animal diseases and performing surgery on sick animals, as well as laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

There were 18 colleges of veterinary medicine in the United States in 1967. Some of the qualifications considered important by these colleges in selecting students are a good scholastic record, amount and character of preveterinary training, good health, and an understanding and affection for animals. Since veterinary colleges are largely State supported, residents of the State in which the college is located are usually given preference. In the South and West, regional educational plans permit cooperating States without veterinary schools to send a few students to designated regional schools. In other areas, colleges accept a certain number of students from other States, usually giving priority to applicants from nearby States which do not have veterinary schools. Although women students are accepted by all colleges of veterinary medicine, the number of women admitted to the schools is relatively small; only about 6 percent of the undergraduates in 1967 were women.

Needy students may obtain loans up to \$2,500 a year to pursue full-time study leading to the degree of Doctor of Veterinary Medicine under provisions of the Veterinary Medical Education Act of 1966. The U.S. Department of Agriculture offers students who have completed their junior year in schools of veterinary medicine opportunities to serve as trainees during the summer months.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many start their own practice with a modest financial investment in such essentials as drugs, instruments, and an automobile. A more substantial financial investment is required to open an animal hospital or purchase an established practice. Newly qualified veterinarians who enter the Army are commissioned as **captains**; those entering the Air Force

do so as first lieutenants. New graduates who pass Federal civil service examinations can qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, and research assistants.

### Employment Outlook

Veterinarians are expected to have very good employment opportunities through the 1970's. Although an increase in the demand for veterinary services is anticipated in the years ahead, the number of veterinarians will be restricted by the limited capacity of schools of veterinary medicine. However, some expansion in veterinary school facilities is expected because of the passage of the Veterinary Medical Education Act of 1966 which provides funds to assist in the construction of new training facilities for veterinarians. Nevertheless, most of the veterinarians who will receive degrees will be needed to replace those who retire or die. As a result, the demand for veterinarians will probably exceed the supply during the 1965-75 decade.

Among the factors underlying the increasing need for veterinary services are the following: An increase in the number of livestock and poultry required to feed an expanding population; a growing pet population resulting from a trend toward suburban living; and an increase in veterinary research. Emphasis on scientific methods of raising and breeding livestock and poultry, and the growth in domestic and international public health and disease-control programs will probably also add to the opportunities for veterinarians.

Women will continue to have good opportunities, especially in small animal practice, teaching, and research.

### Earnings and Working Conditions

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. As they gain experience, their incomes usually increase substantially.

The average annual salary of veterinarians employed by State governments was \$11,500 in 1967, and the average annual salary of veterinarians employed by universities was \$13,500, according to the American Veterinary Medical Association. The income of veterinarians in private practice is generally higher than that of other veterinarians, according to the limited data available.

Newly graduated veterinarians with no experience had an annual starting salary of \$8,218 in the Federal Government in early 1967. Summer trainees in the U.S. Department of Agriculture were paid \$124 for each week they worked (representing a rate of \$6,451 a year).

Veterinarians are sometimes exposed to danger of physical injury, disease, and infection. Those in private practice are likely to have long and irregular working hours. Veterinarians in rural areas may have to spend much time traveling to and from distant farms and may have to work outdoors in all kinds of weather. 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,  
Ill. 60605.

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

Agricultural Research Service,  
U.S. Department of Agriculture,  
Washington, D.C. 20250.

## MATHEMATICS AND RELATED FIELDS

Mathematics is both a profession and a tool essential for many kinds of work. The expression of ideas in mathematical language provides a framework within which these ideas can be understood. Mathematics has always been fundamental to science, engineering, and human affairs. The impact of mathematical methods on these fields has been greatly increased by the widespread use of high-speed electronic computers. For example, the applications of mathematics have opened up broad new horizons, not only in the natural sciences and engineering, but also in the social sciences, medicine, and management and administration. As a result, employment opportunities for persons trained in mathematics have expanded remarkably in the past 15 years.

This chapter includes descriptions of the occupation of mathematician and the two closely related occupations of statistician and actuary. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

In addition to the professions covered in this chapter, workers in many other jobs use mathematics extensively in performing their work. These workers include engineers, chemists, physicists, astronomers, geophysicists, biological scientists, and programmers, each of whose work is



Mathematician manipulates matrix device to solve problem.

discussed elsewhere in the *Handbook*. Secondary school teachers of mathematics are not covered in this chapter but are included in the separate statement on Secondary School Teachers.

### MATHEMATICIANS

(D.O.T. 020.088)

#### Nature of Work

Mathematics is one of the oldest and most basic sciences. Yet, it is also

one of the most dynamic and rapidly growing professions. Mathematicians today are engaged in a wide variety of challenging activities, ranging from the creation of new mathematical theories to the translation of scientific and managerial problems into mathematical terms.

Mathematical work may be divided into two broad classes: pure or theoretical mathematics; and applied mathematics, which includes mathematical computation. Theoretical mathematicians develop mathematical principles and discover relationships among mathematical forms.

They seek to increase basic mathematical knowledge without necessarily considering its use. Yet, this pure and abstract mathematical knowledge has been instrumental in many scientific and engineering achievements. For example, a seemingly impractical non-Euclidean geometry invented by Bernhard Riemann in 1854 became an integral part of the theory of relativity developed by Albert Einstein more than a half-century later.

Mathematicians engaged in applied work develop theories, techniques, and approaches to solve practical problems in the physical, biological, and social sciences. They analyze the various parts of a problem and describe the existing relationships in mathematical terms. Their work ranges from the analysis of vibrations and stability of rockets in outer space to studies of the effects of new drugs on disease. Applied and pure mathematics are not always sharply separated in practice; many important developments in theoretical mathematics have arisen directly from practical problems. For example, in recent years, John von Neumann developed the theory of games of strategy to improve the methods of analyzing conflicts between competing interests, such as those occurring in war and economics.

An important part of the work in applied mathematics involves using mathematical knowledge and modern computing equipment to obtain numerical answers to specific problems. Some work in this area, such as development and programming of advanced techniques for solving complex scientific and engineering problems, requires a very high level of mathematical knowledge, skill, and ingenuity. However, much of this work, such as that performed by many programmers for digital computers, may not require the advanced training and inventiveness of the mathematician. (See statements on Programmers and Systems Analysts. For other occupations related to the mathematics profession, see statements on Statisticians and Actuaries in this chapter.)

The largest number of mathematicians are involved in research and development activities. Nearly as many are primarily teachers, many of whom do part-time research. Most of the remainder are concerned chiefly with operations research, production and inspection (quality control) of manufactured products, or management and administration—particularly of research and development programs.

### Where Employed

Approximately 57,000 mathematicians were employed in the United States in early 1967; about 10 percent were women. About one-half of all mathematicians were employed by private industry. Over half of this group worked in manufacturing—primarily in the electrical equipment, aerospace, machinery, and ordnance industries. Other mathematicians were employed as consultants.

Colleges and universities employed more than two-fifths of all mathematicians, some of whom have few or no teaching duties. Others were employed by the Federal Government, chiefly by the Department of Defense. A few worked for State and local governments and nonprofit organizations.

Mathematicians were employed in all States. However, they were concentrated in those States with large industrial areas and sizable college and university enrollments. Over half of the total were found in seven States: California, New York, Massachusetts, Pennsylvania, Illinois, New Jersey, and Maryland.

### Training, Other Qualifications, and Advancement

The minimum educational requirement for most beginning positions in mathematics is the bachelor's degree with a major in mathematics, or with a major in an applied field—such as physics or engineering—and a minor

in mathematics. For many entrance positions, particularly in research or teaching, graduate training in mathematics is required. Advanced study is also valuable for advancement to more responsible positions in all types of work.

The bachelor's degree in mathematics is offered by more than a thousand colleges and universities throughout the country. The undergraduate mathematics curriculum typically includes courses in analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra.

Advanced mathematics degrees are conferred by more than 250 colleges and universities. In graduate school, the student builds upon the basic knowledge acquired in the undergraduate curriculum. He usually concentrates on a specific field of mathematics, such as algebra, mathematical analysis, statistics, applied mathematics, or topology, by conducting intensive research and taking advanced courses in that field.

The bachelor's degree is adequate preparation for many positions in private industry and the Federal Government, particularly those connected with computer work. Some new graduates with the bachelor's degree assist senior mathematicians by performing computations and solving less advanced mathematical problems in applied research. Others work as graduate teaching or research assistants in colleges and universities, while working toward advanced degrees.

Advanced degrees are required for an ever-increasing number of jobs in industry and Government—in research and in many areas of applied mathematics. The Ph. D. degree is necessary for full faculty status at most colleges and universities, as well as for advanced research positions.

For work in applied mathematics, training in the field to which the mathematics will be applied is very important. Fields in which applied mathematics is used extensively include physics, engineering, and opera-



tions research; other fields include business and industrial management, economics, statistics, chemistry, biology, and the behavioral sciences. Training in numerical analysis and programming is especially desirable for mathematicians working with computers.

### Employment Outlook

Very rapid growth in employment of mathematicians is anticipated for the remainder of the 1960's and through the 1970's. As in the early and mid-1960's, there will be a particular demand for mathematicians with Ph. D. degrees for research, teaching, and applied mathematics positions.

A major factor that should continue to make mathematics one of the most rapidly growing fields is the growth in scientific research and development, in which a large number of mathematicians are engaged. Expenditures for research and development have risen steadily in recent years and are expected to continue to rise through the 1970's, although at a somewhat slower rate than in the past.

Mathematicians in research and development use high-speed electronic computers to solve a wide variety of complex problems in engineering, natural and social science research, military science, operations research, and business management. There will be a growing need for mathematicians with a high degree of mathematical competence and a broad knowledge of these particular fields of application. The demand for people to do mathematical computation work will also expand.

The employment of mathematicians as college and university teachers should rise very substantially through the 1970's, when enrollments are expected to grow rapidly. Not only is the number of students majoring in mathematics expected to increase sharply, but the number of students majoring in other fields taking mathematics courses will also rise.

Colleges and universities will continue to provide most of the employment opportunities for specialists in theoretical mathematics.

Between 1965 and 1975, a three-fold increase is expected in the number of mathematics graduates at each degree level. The number of new graduates seeking professional mathematics employment will rise sharply, and competition for entry positions will increase considerably during the remainder of the 1960's and throughout the 1970's. Nevertheless, graduates with advanced degrees and those with bachelor's degrees who have good academic records should find excellent employment opportunities.

The education and training necessary for a degree in mathematics is also an excellent foundation for a number of other occupations, particularly in fields that rely heavily on the application of mathematical theories and methods. Thus, increasing numbers of mathematics graduates are likely to be hired for jobs in teaching, statistics, actuarial work, computer programming, systems analysis, economics, engineering, physics, geophysics, and biological sciences. Employment opportunities in such related fields will probably be best for students who combine their major in mathematics with a minor in one of these other disciplines.

### Earnings and Working Conditions

Annual starting salaries in private industry for mathematicians with bachelor's degrees were about \$7,300 in 1966, according to the limited information available. New graduates with the master's degree received starting salaries averaging about \$1,700 a year higher. Yearly salaries for new graduates with Ph. D. degrees, most of whom have some experience, ranged from about \$10,300 to \$17,000 in 1966.

In the Federal Government in early 1967, mathematicians with the bachelor's degree and no experience could start at either \$6,387 or \$7,729 a year,

depending on their college records. Beginning mathematicians who had completed all requirements for the master's degree could start at \$7,729 or \$9,001; those with the Ph. D. degree could begin at either \$10,481 or \$11,360 a year.

In colleges and universities, starting salaries for mathematicians with the Ph. D. degree who were employed as teachers in 1966, ranged from about \$6,000 to \$12,000 for 9 months of teaching. Mathematicians in educational institutions often supplement their regular salaries with income from special research projects, consulting work, and writing.

The average (median) annual salary for mathematicians in the National Science Foundation's National Register of Scientific and Technical Personnel was \$12,000 in 1966. Only 10 percent earned less than \$7,500 a year, and about 10 percent earned \$20,000 or more.

### Where To Go for More Information

General information on the field of mathematics—including career opportunities, professional training, colleges and universities with degree-credit programs, and earnings—may be obtained from:

American Mathematical Society,  
P.O. Box 6248, Providence, R.I.  
02904.

Mathematical Association of America,  
SUNY at Buffalo, Buffalo, N.Y.  
14214.

Association for Computing Machinery,  
211 East 43d St., New York, N.Y.  
10017.

Society for Industrial and Applied Mathematics,  
33 South 17th St., Philadelphia,  
Pa. 19103.

Specific information on careers in applied mathematics and electronic computer work may be obtained from the last two organizations.

Federal Government career information may be obtained from any re-

gional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C.,  
1900 E St. NW., Washington, D.C. 20415.

Other sources of information on related occupations, such as Statisticians, Actuaries, Programers, and Systems Analysts, may be found elsewhere in the *Handbook*.

## STATISTICIANS

(D.O.T. 020.088 and .188)

### Nature of Work

More than ever before, the characteristics of the world and its inhabitants are being described in numerical

terms. Statisticians collect, analyze, and interpret these data. They use statistical methods to help corroborate the findings of natural and social scientists. Their studies provide government and business officials with the statistical information needed to make decisions and establish policy.

The work of the statistician is of two general types—applied and mathematical. Applied statisticians develop and analyze data, based on their knowledge of a particular field, such as economics, demography, behavioral science, education, physical science, or engineering. They may forecast population growth or economic conditions, predict and evaluate the results of new programs, develop quality control tests for manufactured products, or help decision-makers select from alternative choices.

Mathematical statisticians use

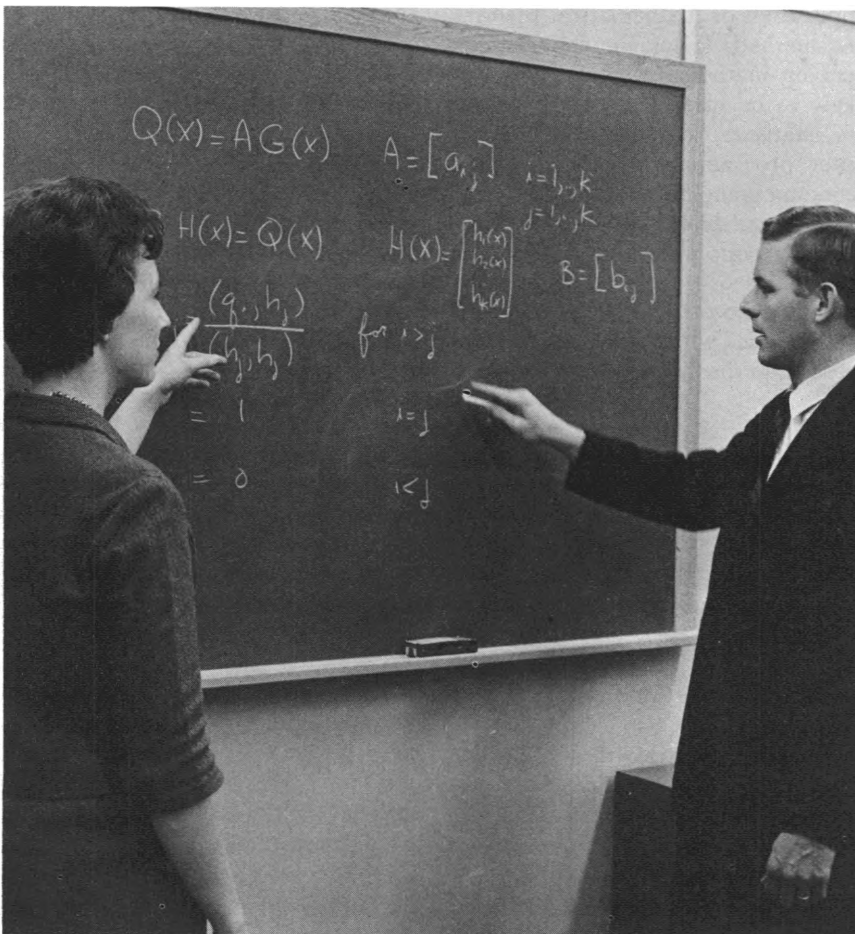
mathematical theory to design and improve statistical methods for obtaining and interpreting numerical information. They develop statistical tools in areas such as probability, experimental design, and regression analysis. Unlike applied statisticians, mathematical statisticians usually do not specialize in a subject-matter field. However, the latter frequently work with applied statisticians in making statistical studies.

Many statisticians are engaged primarily in planning surveys, designing experiments, or analyzing data. Those who plan surveys select the data sources, determine the type and size of the sample groups, and develop the survey questionnaire or reporting form. They prepare the instructions for those who will collect or report the information and for the workers who will code and tabulate the returns. Statisticians who design experiments prepare mathematical models that will test a particular theory. Those in analytical work interpret collected data and summarize their findings in tables, charts, and written reports. Another large group of statisticians perform chiefly administrative functions in connection with statistical programs. Others are teachers who often combine research with teaching. The remainder are involved in other activities, such as quality control, operations research, production and sales forecasting, and market research.

Because statistics have such wide use, it is sometimes difficult to distinguish professional statisticians from those subject-matter specialists making a limited use of statistics. For example, an applied statistician working with data on economic conditions may have the title of economist, or a mathematical statistician applying probability theory to the development of new statistical methods may be classified as a mathematician.

### Where Employed

Approximately 22,000 professional statisticians were employed in early



Statisticians apply mathematical theories in solving problems.

1967; about one-third were women. Nearly one-half of all statisticians were employed by private industry, being divided almost equally between the manufacturing and nonmanufacturing industry groups. The largest numbers worked for insurance and financial organizations, and independent consulting firms.

Federal Government agencies employed approximately 2,400 statisticians in 1967, more than three-fourths of whom worked for the Departments of Commerce; Defense; Agriculture; and Health, Education, and Welfare. Colleges and universities employed some applied statisticians and a large number of mathematical statisticians. Other statisticians were employed by State and local governments, and nonprofit organizations.

Although statisticians were employed in all States, about one-half of them worked in New York, the District of Columbia, California, Maryland, Pennsylvania, or Illinois.

### **Training, Other Qualifications, and Advancement**

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning positions in applied and mathematical statistics. For some beginning positions in applied statistics, however, a bachelor's degree, with a major in economics or some other subject-matter field and a minor in statistics, is preferable. A master's degree in statistics or mathematics is required for many entrance positions in mathematical statistics and teaching, and is almost indispensable for promotion to more responsible positions in mathematical statistics. The Ph. D. degree is essential for full faculty status at most colleges and universities, as well as being an asset for advancement to top administrative and consulting positions. Advancement in analytical and survey work usually requires advanced academic training in the subject-matter field as well as in statistics.

Relatively few colleges and universities offer training leading to a bachelor's degree with a major in statistics. Most schools, however, offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Courses essential for statisticians include college algebra, plane trigonometry, analytical geometry, differential and integral calculus, linear algebra, and at least one course in statistical methods. Other important courses cover sampling, correlation analysis, experimental design, probability theory, and computer uses and techniques. For many quality control positions, training in engineering and in the application of statistical methods to manufacturing processes are desirable. For many market research, business analysis, and forecasting positions, courses in economics, business administration, or a related field are helpful.

Graduate degrees in statistics were conferred by approximately 40 colleges and universities in 1966, and many other schools offered one or two graduate level statistical courses. In many schools where statistics is still part of the mathematics department, the graduate student interested in mathematical statistics earns his advanced degree in mathematics. Entrance into a graduate program in statistics usually requires a bachelor's degree with a good background in mathematics. The student interested in applied work should attend a school where he can pursue research projects in his subject-matter field, as well as take advanced courses in statistics.

Inexperienced statisticians with only the bachelor's degree often spend much of their time in statistical clerical work, or its supervision, on their first jobs. With experience, they usually advance to positions of greater technical and supervisory responsibility. Those with exceptional ability and interest may be promoted to top management positions.

Among the personal qualifications needed by statisticians are an interest

and facility in mathematics, and the ability to translate practical problems into statistical terms.

### **Employment Outlook**

The employment outlook for statisticians is expected to be good through the remainder of the 1960's and the 1970's. The growing emphasis on modern statistical methods in conducting research and the increasing use of electronic computers should strengthen the demand for statisticians in industry, government, and colleges and universities.

The largest expansion in employment is expected in private industry. Persons who have broad training in mathematics and statistics, as well as a knowledge of engineering or the physical sciences, will be needed for quality control work in manufacturing, and for work with scientists and engineers in research and development activities. Business firms are expected to rely more and more on statisticians, especially those with a background in economics or business administration, to forecast sales, analyze business conditions, modernize accounting procedures, and help solve other management problems.

The employment of statisticians in Federal Government agencies will probably increase moderately. Additional personnel will be needed not only in research and development work, but also for expanded programs in such fields as social security, health, and education. Some statisticians will also be needed to fill positions in continuing programs which involve the collection and analysis of many kinds of social and economic data.

The employment of statisticians as college and university teachers is expected to rise through the 1970's, primarily as a result of the overall growth in enrollments. Many colleges will offer additional courses in statistics, as the application of statistical methods becomes more widespread.

In addition to the number needed to fill new positions, several hundred statisticians will be required each year

to replace members of the profession who retire, die, or transfer to other occupations.

Along with the anticipated rise in the demand for statisticians, an increase is expected in the number of statistics graduates. However, in 1965 the number of these graduates was barely enough to meet replacement needs. Thus, employment opportunities for new college graduates with degrees in statistics at all degree levels are expected to be very good through the 1970's.

### Earnings and Working Conditions

Starting salaries for new college graduates employed as applied statisticians in private industry generally averaged between \$5,500 and \$7,200 a year in 1966, according to the limited information available. Starting salaries for mathematical statisticians with the bachelor's degree were usually somewhat higher. Salaries for beginning statisticians with the master's degree averaged about \$1,500 a year more than for those with only the bachelor's degree.

In the Federal Government service in early 1967, applied statisticians with the bachelor's degree and no experience could start at either \$5,331 or \$6,451 a year, depending on their scholastic records. Beginning statisticians who had completed all requirements for the master's degree could start at \$6,451 or \$7,696. Those with the Ph. D. degree could begin at \$9,221 or \$10,927. Federal Government entrance salaries for mathematical statisticians were somewhat higher than for analytical and survey statisticians.

Statisticians employed by colleges and universities generally earn somewhat less than those employed by private industry and the Federal Government. Some indication of the salary levels of statisticians employed as teachers may be obtained from the earnings data for college and university teachers as a group. (See statement on College and University Teachers.) In addition to their regu-

lar salaries, statisticians in educational institutions sometimes earn extra income from outside research projects, consulting work, and writing.

### Where To Go for More Information

American Statistical Association,  
810 18th Street, NW., Washington,  
D.C. 20006.

Association for Computing Machinery,  
211 East 43d St., New York, N.Y.  
10017.

Institute of Mathematical Statistics,  
Department of Statistics,  
California State College at Hayward,  
Hayward, Calif. 94542.

Interagency Board of U.S. Civil Service Examiners for Washington, D.C.,  
1900 E St. NW., Washington, D.C.  
20415.

Society for Industrial and Applied Mathematics,  
33 South 17th St., Philadelphia, Pa.  
19103.

## ACTUARIES

(D.O.T. 020.188)

### Nature of Work

Actuaries are responsible for designing insurance and pension plans and for maintaining these programs on a sound financial basis. They are concerned with rates of mortality (death), morbidity (sickness), injury, disability, unemployment, retirement, and property loss from accident, theft, fire, and other potential hazards. Actuaries use statistical data and other pertinent information to construct tables on the probability of insured loss. They develop and analyze estimates of the insurer's future earnings and investment income, expenses, and policyholder claims. Taking all these factors into consideration, actuaries determine the premium rates and policy contract provisions for each type of insurance offered. Most actuaries specialize in

either life insurance or property and liability (casualty) insurance.

To perform their duties effectively, actuaries must keep abreast of general economic and social trends and legislative, health, and other developments that may affect insurance practices. Because of their broad knowledge of the insurance field, actuaries frequently work on problems arising in investment, underwriting, group insurance, and pension sales and service departments. Actuaries in executive positions may help determine general company policy. In that role, they may also testify before public agencies on proposed legislation affecting the insurance business, or to justify intended changes in premium rates or contract provisions.

Actuaries employed by the Federal Government usually deal with a particular Government insurance or pension program, such as social security (old-age, survivors, disability, and health insurance) or life insurance for veterans and members of the Armed Forces. Actuaries in State government positions are involved in the supervision and regulation of insurance companies, the operation of State retirement or pension systems, and problems connected with unemployment insurance or workmen's compensation. Consulting actuaries perform services for private companies, unions, and government agencies, such as setting up pension and welfare plans and making periodic actuarial evaluations of these plans.

### Where Employed

Approximately 3,000 professional actuaries were employed in the United States in early 1967; less than 3 percent were women. Actuaries were concentrated in those States that are major centers of the insurance industry. About three-fifths of all actuaries were employed in four States—New York, Connecticut, Illinois, and Massachusetts.

Private insurance companies employed about two-thirds of all actuaries. The great majority of this

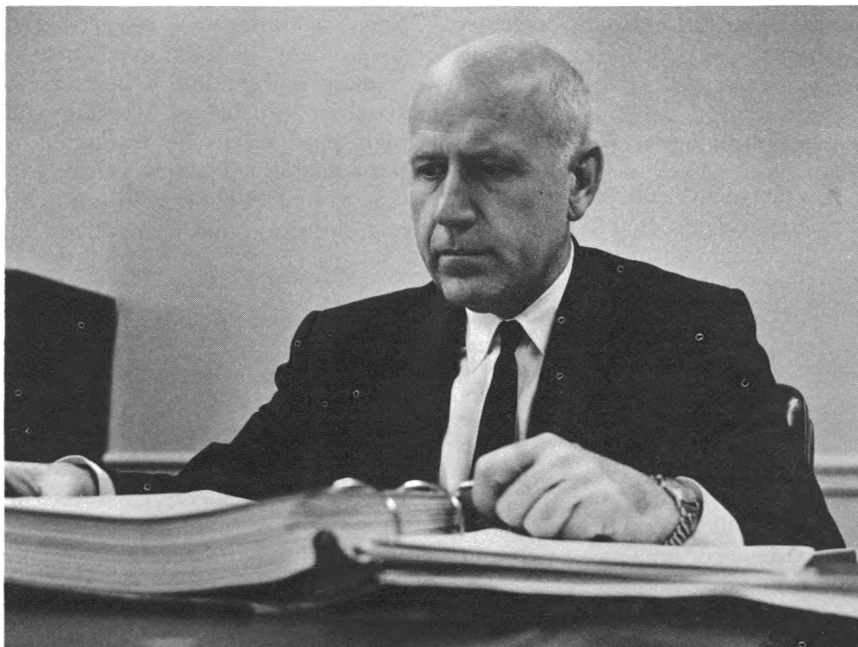
group worked for life insurance companies; the remainder worked for property and liability (casualty) companies. The size of an insurance company's actuarial staff depends primarily upon the volume of its insurance work. Large companies may employ as many as 50 to 100 actuaries. Small companies may have only a few actuaries on their staffs or rely instead on rating bureaus or consulting firms.

Rating bureaus (associations which supply actuarial data to member companies) and consulting firms employed nearly one-third of all actuaries. Most of the remainder were employed by private organizations to administer independent pension and welfare plans. Others worked for Federal or State Government agencies. A few taught in colleges and universities.

### Training, Other Qualifications, and Advancement

A bachelor's degree with a thorough foundation in calculus, probability, and statistics is required for entry into actuarial work. The new graduate with a major in such fields as mathematics, statistics, economics, or business administration can usually qualify for beginning actuarial positions. The prospective actuary should take courses in algebra, analytical geometry, differential and integral calculus, mathematical statistics, and probability. Other desirable courses include insurance law, economics, investments, accounting, and other aspects of business administration. Although only about 10 colleges and universities offer training specifically designed for actuarial careers, several hundred institutions offer the necessary courses.

It usually takes from 5 to 10 years after entering a beginning actuarial position to complete the entire series of examinations required for full professional status. These examinations cover general mathematics, specialized actuarial mathematics, and all phases of the insurance business.



Actuary refers to tables of sickness and death rates.

Those considering an actuarial career should take the beginning examinations covering general mathematics while still in college. Success in passing these first examinations helps the beginner to evaluate his potential as an actuary. Those who pass these examinations usually have better opportunities for employment and a higher starting salary. The advanced examinations, usually taken by those in junior actuarial positions, require extensive home study and experience in insurance work.

The 10 actuarial examinations for the life insurance field are given by the Society of Actuaries, and the eight for property and liability (casualty) insurance by the Casualty Actuarial Society. Since the first two parts of the examination series of either Society are the same, the student may defer the selection of his insurance specialty until he has acquired more familiarity with the field. "Associate" membership is awarded after completion of half of the full examination series in either specialty; the designation of "Fellow" is conferred after the successful completion of the entire series of examinations.

Employers frequently give preference to applicants who have passed one or more of the actuarial examinations, or to those with actuarial experience gained in the special summer training programs for college students offered by some insurance companies. A beginning actuary is usually rotated among different jobs to learn various actuarial operations and to become familiar with different phases of insurance work. At first, his work may be rather routine, such as preparing calculations or tabulations for actuarial tables or reports. As he gains experience, he may supervise actuarial clerks and prepare correspondence and reports.

Advancement to more responsible work as assistant, associate, and chief actuary depends largely upon the individual's on-the-job performance and the number of actuarial examinations he has successfully completed. Many actuaries, because of their broad knowledge of insurance and related fields, qualify for administrative positions in other company activities, particularly in underwriting, accounting, or data-processing departments. A significant number of

actuaries advance to top executive positions.

### Employment Outlook

Employment opportunities for actuaries are expected to be excellent for the remainder of this decade and through the 1970's. New graduates who have the necessary mathematical education and who have passed some actuarial examinations will be in particular demand as trainees.

Actuarial employment is expected to grow, primarily because of the rising numbers of insurance policies of all kinds which result, in part, from the existence of an affluent and more insurance-conscious population and business community. Actuaries will be needed to solve the growing number of problems arising from continuously changing and increasingly complex insurance and pension coverage. The expanding number of group health and life insurance plans and pension and other benefit plans will require actuarial services. Addi-

tional actuaries will be needed by government regulatory agencies. Demand will continue to be strong for actuaries capable of working with high-speed electronic computers. A few actuaries will also be needed each year to replace those who retire, die, or transfer to other occupations.

### Earnings and Working Conditions

Starting salaries of new college graduates entering actuarial work as trainees in insurance companies were generally about \$6,500 a year in 1966, according to a survey conducted by the Life Office Management Association. Annual starting salaries for those who had passed the first few actuarial examinations were as much as \$2,500 more than inexperienced new graduates. Those with experience gained in the insurance companies' summer intern (training) programs usually received higher entrance salaries.

In the Federal Government service in early 1967, new graduates with the

bachelor's degree entering actuarial work could start at either \$6,387 or \$7,729 a year, depending on their college records.

Beginning actuaries can look forward to a marked increase in earnings as they gain professional experience and successfully complete either Society's series of examinations. In some insurance companies, merit pay increases are given to those who pass one or a group of the examinations. Most Fellows of either of the Society of Actuaries or the Casualty Actuarial Society earn over \$12,000 a year. Many actuaries earn more than \$20,000 a year, and those in executive positions in large companies earn over \$25,000.

### Where To Go for More Information

Casualty Actuarial Society,  
200 East 42d St., New York, N.Y.  
10017.

Society of Actuaries,  
208 South LaSalle St., Chicago, Ill.  
60604.

meteorology (3,500), and oceanography (3,000).

A bachelor's degree is the usual minimum educational requirement for work in the natural sciences. Graduate training is needed for many positions, especially in teaching and research, and is helpful for advancement in all types of work. In some fields, advanced degrees are needed for most positions.

Employment in the natural sciences has grown rapidly in recent years and the outlook is for continued rapid growth through the 1970's. In general, the most important factor underlying the expected increase in employment is the likely growth of expenditures for research and development. Such expenditures have increased rapidly in recent years and are expected to continue to increase, although somewhat more slowly than in the past. Other factors contributing to the expected employment growth in the natural sciences are the expansion of industry, the increasing complexity of industrial products and processes, and the sharp increase in science enrollments expected in colleges and universities.

The following chapter presents descriptions of some of the major occupations within the natural sciences. In addition to these occupations, workers in many other fields may require a strong background in the natural sciences. Included are engineering, mathematics, and medical occupations, which are described elsewhere in the *Handbook*.

## Biological Sciences

The biological sciences are often called life sciences, since they encompass all living organisms and the things that determine the nature of life. They are concerned with men and microbes, plants and animals, and health and disease.

Some scientists in this field perform research to expand our under-

standings of living things. Others, who teach, pass this knowledge on to students. Many scientists pursue both activities. Still others apply these concepts and principles to the solution of practical problems, such as the development of new drugs or varieties of plants.

This chapter discusses biological scientists as a group since they receive comparable basic training and have similar employment and earning prospects. Brief statements are provided about the nature of the work of a number of biological scientists—including botanists, microbiologists, zoologists, biophysicists, pathologists, and pharmacologists. More detailed statements for other professional workers in the biological sciences—biochemists, soil scientists, soil conservationists, foresters, and range managers—are discussed elsewhere in the *Handbook*.

## BIOLOGICAL SCIENTISTS

(D.O.T. 040.081, 041.081, 070.081, and 077.128)

### Nature of Work

Biological scientists study living organisms, their structure, evolutionary development, behavior, and life processes. They also study the relation between these organisms and their environment. The number and variety of plants and animals are so vast and the life processes so varied and complex that biologists must of necessity become specialists. Some biologists learn as much as possible about a particular kind of animal, plant, or micro-organism. Others, interested in how an animal or human body functions, study such things as the nervous system, how food is digested, or how organisms are affected by disease. Some are interested in the evolution of living organisms, the mechanisms of heredity, or the ways environmental factors, such as light or heat, affect life processes. In general, biological scientists specialize in a sub-

## NATURAL SCIENCES

The natural sciences are concerned with the physical world and the living things within it. These sciences may be divided into three broad groups—biological, earth, and physical sciences—all of which are discussed in this chapter. Mathematics, often considered part of the natural sciences, is discussed in a separate chapter elsewhere in the *Handbook*.

The physical sciences are the largest field of employment among the natural sciences; over 195,000 physical scientists were employed in early 1967.

Chemistry is by far the largest of the physical science specialties, with about 122,000 chemists employed in early 1967. Smaller numbers were in physics (44,000), astronomy (1,100), and other physical sciences (28,500), which includes metallurgy.

A large number of natural scientists—nearly 155,000 in early 1967—worked in the biological sciences. Most of these scientists specialized in 1 of 3 broad fields—biology, medicine, or agriculture. The largest number, more than 68,000, worked in biology. More than 47,000 were employed as agricultural scientists, and nearly 40,000 worked on problems related to medicine.

The earth sciences are relatively small fields of scientific employment. In early 1967, the number of earth scientists totaled about 26,500. Of these, the largest number (15,000) worked in geology. Smaller numbers were employed in geophysics (5,000),

discipline of the three broad areas of the life sciences—biological, medical, or agricultural science.

About two-fifths of all biological scientists are engaged in research and development. Many conduct basic research, aimed at adding to our knowledge of living organisms with only secondary regard to its application. Nevertheless, the development of insecticides, disease-resistant crops, and antibiotics have all stemmed from basic research in the biological sci-

ences, since much of the basic medical knowledge of the treatment of disease has its origin in pure biological science.

Biological research may take many forms. 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 previously unknown kinds of animals are both doing research, as is an entomologist in a laboratory testing vari-

ous chemical insecticides for effectiveness and possible hazards to human and animal life.

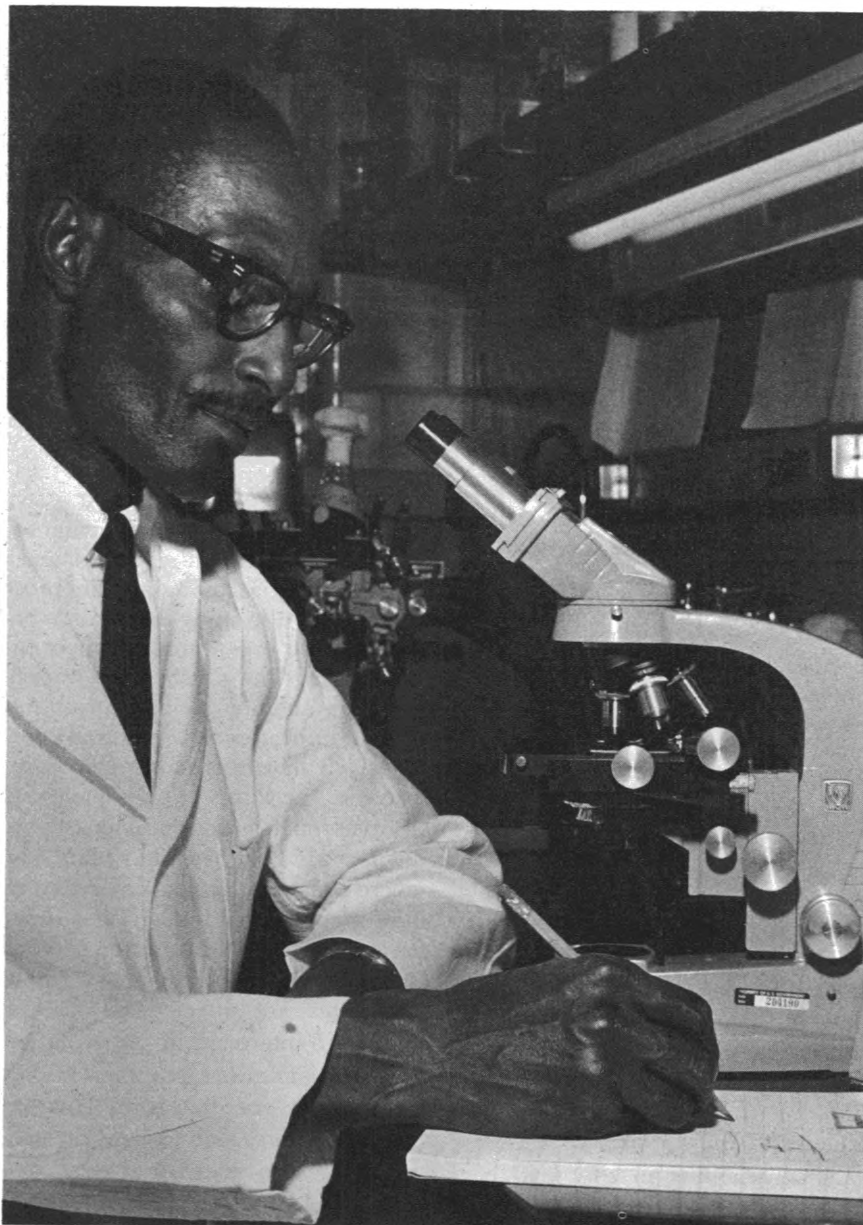
Regardless of the type of research in which they are engaged, biological scientists must be familiar with fundamental biological research techniques and with the use, not only of light and electron microscopes, but of other complex physical and electronic laboratory equipment. Advanced techniques and principles drawn from chemistry and physics are used widely. A knowledge of mathematical and statistical procedures, as well as of the operation of electronic computers, is often needed in experiments involving a large number of variable factors.

Teaching is the major function of more than a fourth of all biological scientists. Many teachers of biological sciences combine independent research with their regular teaching duties, and in some large educational institutions spend the major portion of their time on research.

Another fourth of the biological scientists are engaged in management and administrative work, primarily the planning, supervision, and administration of programs of research or testing of foods, drugs, and other products. Others provide liaison between the Federal Government and the agricultural experiment stations at State universities, assisting in the planning, development, and evaluation of research programs at these stations.

The remaining biologists are engaged in a variety of other types of work, such as consulting, writing, testing, and inspection. A few are employed in technical sales or field service work for industrial firms; such work may include, for example, teaching company salesmen and prospective purchasers the value and proper use of new chemicals. Some are engaged in research in natural history museums, zoos, and botanical gardens.

Biological scientists may be classified into three broad groups characterized by the general type of



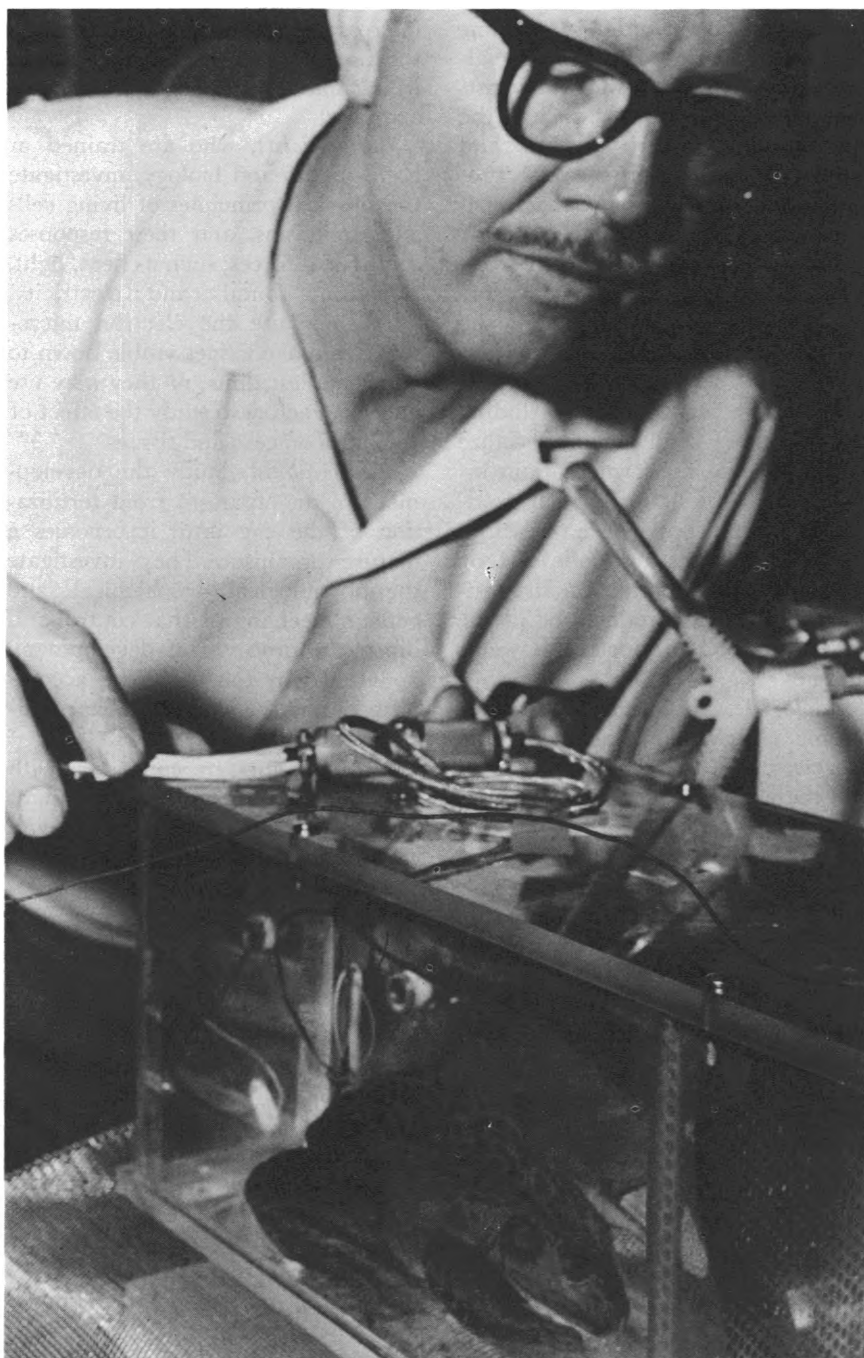
**Biological scientist notes findings during microscopic examination.**



organism with which they work: Botanists, who study plants; zoologists, who are concerned with animals; and microbiologists, who work with micro-organisms.

Biological scientists may also be classified according to their specialties—some of which are wholly within 1 of the 3 major groupings, and others which can be found in all 3 groups. For example, some biological scientists are classified according to the specific type of organism studied, as are mycologists, who are botanists concerned with the study of fungi. Others are classified according to the type of approach used, as are geneticists, who may be botanists, zoologists, or microbiologists studying the mechanisms of the heredity of a particular plant, animal, or micro-organism. Scientists whose work cuts across more than one of these major groupings, often the case with college teachers, may simply call themselves biologists. A description of the work of some biological scientists follows.

*Botanists* study all aspects of plant life. Plant taxonomists identify and classify plants. Plant ecologists study the effects of environmental elements on plant life and distribution. Other botanists include plant morphologists, concerned with the structure of plants



Biophysicist prepares frog for experiment on effects of "weightlessness."



Plant physiologist examines research plants in special growth chamber.

and plant cells; plant physiologists, interested in the life processes of plants; and plant pathologists, engaged in determining the cause and control of plant diseases.

*Microbiologists* investigate the growth, structure, and general characteristics of bacteria, viruses, molds,

and other organisms of microscopic or submicroscopic size. Although the terms bacteriology and microbiology are sometimes used interchangeably, microbiology, the broader term, is preferable when referring to the study of all microscopic organisms. Microbiologists isolate and make cultures of

these organisms in order to examine them with a variety of highly specialized equipment. Some microbiologists pursue medical problems, such as the relationship between bacteria and infectious disease, or the effect of antibiotics on bacteria. Others specialize in soil bacteriology (the study of soil micro-organisms and their relation to soil fertility), virology (the study of viruses), immunology (the study of the mechanisms that fight infection), or serology (the study of animal and plant fluids, including blood serums). Still others specialize in the study of the fermentations involved in manufacturing such products as beer and wine, or in the search for new or better antibiotics. Many specialize in the production and testing of biological products or in the testing of food products and water supplies.

*Zoologists* study animal life—its origin, classification, behavior, life processes, diseases, and parasites—and the ways in which animals influence and are influenced by their environment. Zoologists who specialize in the study of certain classes of animals usually use titles which indicate the kind of animal studied, such as ornithologists (birds), herpetologists (reptiles and amphibians), ichthyologists (fishes), and mammalogists (mammals).

*Agronomists* are concerned with field-crop problems. They develop new methods of growing crops for improved quality, higher yield, and more efficient production. They seek new, hardier varieties of crops and better methods of controlling disease, pests, and weeds. Agronomists may specialize in the problems of a geographical region, a particular crop, or a technical area such as crop breeding or production methods.

*Anatomists* study the form and structure of animal bodies. Those who specialize in the structure of cells are known as cytologists, while those who specialize in the structure of tissues and organs are known as histologists. Anatomists may examine structures visible to the naked eye or of microscopic size, or those of sub-

microscopic size, visible only through the use of the electron microscope. Many anatomists specialize in human anatomy.

*Biophysicists*, who are trained in both physics and biology, investigate the physical principles of living cells and organisms, and their responses to physical forces, such as heat, light, radiation, sound, and electricity. They may use the electron microscope to make tissues visible down to their smallest units, or they may use nuclear reactors to study the effect of radiation on cells and tissues.

*Embryologists* study the development of an organism from fertilization of the egg until it becomes a mature organism. They investigate the physiological, biochemical, and genetic mechanisms that control and direct the processes of development, how and why this control is accomplished, and the causes of abnormalities in development.

*Entomologists* are concerned with insects and their relation to plant and animal life. They identify and classify the enormous number of different kinds of insects. Some entomologists seek methods of controlling harmful insects that carry disease and spoil food supplies. Others develop ways to encourage the growth and spread of beneficial insects, such as honeybees.

*Geneticists* explore the origin, transmission, and development of hereditary characteristics. Geneticists engaged primarily in improving plant and animal breeds of economic importance—such as cereal and tobacco crops or dairy cattle and poultry—may be classified as plant or animal breeders, agronomists, or animal science specialists. Theoretical geneticists search for the mechanisms that determine inherited traits in plants, animals, or humans.

*Horticulturists* work with orchard and garden plants such as fruits, nuts, vegetables, flowers and ornamental plants, and other nursery stocks. They develop new or improved plant varieties and better methods of growing, harvesting, storing, and transporting horticultural crops. Horticulturists

usually specialize in either a specific plant or a particular technical problem, such as plant breeding.

*Husbandry specialists* (animal) conduct research on the breeding, feeding, management, and diseases of domestic farm animals to improve the health and yield of these animals.

*Nutritionists* examine the processes through which food is utilized; the kinds and quantities of food elements—such as minerals, fats, sugars, vitamins, and proteins—that are essential to build and repair body tissues and maintain health; and how these food elements are transformed into body substances and energy. Nutritionists also analyze food to determine its composition in terms of essential ingredients or nutrients.

*Pathologists* study the nature, cause, and development of disease, degeneration, and abnormal functioning in humans, in animals, or in plants. Many specialize in the study of the effects of diseases, parasites, and insect pests on cells, tissues, and organs. Others investigate genetic variations and other abnormal effects caused by drugs. The term “pathologist” is normally reserved for specialists in human pathology (medical pathology). Specialists in animal pathology are usually veterinarians. (See statement on Veterinarians.) Those who study plant diseases may be called plant pathologists or phytopathologists; their work is discussed under the section on botanists.

*Pharmacologists* conduct tests to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs, and correlate their findings with medical data. They may develop new or improved chemical compounds for use in drugs and medicines.

*Physiologists* study the structure and functions of cells, tissues, and organs and the effects of environmental factors on life processes. They may specialize in cellular activities; or in one of the organ systems, such as the digestive, nervous, circulatory, or reproductive systems. The knowledge gained in such research often provides the basis for the work of many

other specialists, such as biochemists, pathologists, pharmacologists, or nutritionists.

### Where Employed

About 155,000 persons were employed in early 1967 in the biological sciences and the closely related fields of medical and agricultural sciences; an estimated 10 percent were women. About half of the total were employed by colleges and universities. Medical schools and their associated hospitals employed particularly large numbers of biological scientists in the medical field. State agricultural colleges and agricultural experiment stations operated by universities in cooperation with Federal and State Governments employed sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists.

The Federal Government in early 1967 employed about 29,000 biological scientists. The Department of Agriculture employed about two-thirds of these. The Interior Department employed nearly all the fish and wildlife biologists in the Federal Government. Other large numbers of biological scientists were employed by the Department of the Army and the National Institutes of Health. State and local governments, together, employed about 19,000 biologists—mostly fish and wildlife specialists, microbiologists, and entomologists—for work in conservation, detection and control of diseases, and plant breeding.

More than 33,000 biological scientists worked for private industry in early 1967. Among the major industrial employers were manufacturers of pharmaceuticals, industrial chemicals, and food products. Some biological scientists worked for nonprofit organizations—mainly hospitals, clinics, and privately financed research organizations or foundations. A few were self-employed.

Although biological scientists were employed in all States, about a third were located in five States—Califor-

nia, New York, Illinois, Maryland, and Pennsylvania.

### Training, Other Qualifications, and Advancement

Young people seeking professional careers in the biological sciences should plan to obtain an advanced degree—preferably a Ph.D.—in their field of interest. The bachelor's degree with a major in one of the biological sciences in adequate preparation for many beginning jobs, but promotional opportunities for those without graduate training may be limited to intermediate level positions.

The Ph. D. degree is generally required for higher level college teaching positions and for independent research. It is also necessary for an increasing number of other positions involving the administration of research programs.

Biologists with master's degrees can qualify for most entry positions in applied research and for some types of positions in college teaching and basic research.

New graduates with bachelor's degrees can qualify for positions involving testing, production and operation work, technical sales and service, and duties connected with the enforcement of government regulations. They may also obtain positions as advanced technicians, particularly in the area of medical biology. Those who graduate near the top of their class can qualify for some research positions, but these positions are mostly of a routine nature or are performed under close supervision. Some graduates with bachelor's degrees take courses in education and choose a career as a high school teacher of biology rather than one as a biological scientist. (See statement on Secondary School Teachers.)

Training leading to a bachelor's degree with a major in biology or in one of the biological or agricultural specialties is offered by nearly all colleges and universities. Courses differ greatly from one college to another, and it is important that a

student find out which college program best fits his interests and needs. In general, liberal arts colleges and universities emphasize training in the basic biological sciences and in the medical aspects of biological science. State universities and land-grant colleges offer special advantages to those interested in agricultural sciences, because their agricultural experiment stations provide many opportunities for practical training and research work.

Prospective biological scientists should obtain the broadest undergraduate training possible in all branches of biology and in related sciences, particularly organic and inorganic chemistry, physics, and mathematics. Courses in statistics, calculus, and biometrics are becoming increasingly essential. Important also are training and practice in laboratory techniques, in the use of laboratory equipment, and in fieldwork.

Advanced degrees in the biological sciences are also conferred by a large number of colleges and universities. Requirements for advanced degrees usually include fieldwork and laboratory research, as well as classroom studies and preparation of a thesis.

### Employment Outlook

Employment opportunities for biological scientists with graduate degrees are expected to be very good throughout the remainder of the 1960's and the 1970's. Demand will be strong for biological scientists with doctorates to do research on problems important to medicine and health. Employment opportunities are also likely to be favorable for persons with bachelor's degrees who graduate near the top of their class. New graduates holding the bachelor's degree will also find many opportunities to work as research assistants or in technician jobs while continuing their graduate education.

Employment in the biological sciences is expected to grow very rapidly during the remainder of the 1960's and throughout the 1970's. Al-

though most employment opportunities will result from growth, nearly 5,400 biological scientists will be needed each year to replace those who transfer to other fields, retire, or die.

One of the major factors which will tend to increase employment of biological scientists is the anticipated continued growth in research and development, particularly in medical research programs sponsored by the Federal Government and voluntary health agencies, including those promoting studies of heart disease, cancer, and birth defects. Research in such relatively new areas as space biology, radiation biology, environmental biology, biological oceanography, and hereditary and mental regulation will also probably increase.

Industry also is expected to increase its spending for research and development in the biological sciences. Furthermore, the stringent health standards of the Federal regulatory agencies are likely to result in a heightened demand for additional biological scientists in industry to perform research and testing before new drugs, chemicals, and processing methods are made available to the public.

Another factor which should increase employment of biological scientists is the substantially larger college and university enrollments expected during the late 1960's and throughout the 1970's. Although the resulting rise in demand for teachers will be to a large extent for Ph. D.'s, there will be many openings for qualified people holding master's degrees.

### Earnings and Working Conditions

In the Federal Government in early 1967, biological scientists with the bachelor's degree could begin at \$5,331 or \$6,451 a year, depending on their college records. Beginning biological scientists with the bachelor's degree and some graduate study could start at \$6,451, \$7,696, or \$9,221, depending upon academic records and previous experience. Those with the Ph. D. degree could

begin at \$9,221 or \$10,927. Pharmacologists had somewhat higher starting salaries than other biological scientists.

Biological scientists with the Ph. D. degree employed as college and university teachers typically received starting salaries between \$6,500 and \$8,000 a year in 1966, according to the limited information available. (For further information, see statement on College and University Teachers.) Biologists in educational institutions sometimes supplement their regular salaries with income from writing, consulting, and special research projects.

The average (median) annual salary for biological scientists was \$12,000 in 1966, according to the National Science Foundation's National Register of Scientific and Technical Personnel; only 10 percent earned less than \$7,400 a year, and about 10 percent earned \$21,000 or more. In general, biological scientists in private industry tend to have higher salaries than those in either colleges and universities or Government employment. According to the Register, agricultural scientists generally earn somewhat lower salaries than other biological scientists except in educational institutions.

### Where To Go for More Information

American Institute of Biological Sciences,  
3900 Wisconsin Ave. NW., Wash-  
ington, D.C. 20016.

Interagency Board of U.S. Civil  
Service Examiners for Wash-  
ington, D.C.  
1900 E St. NW., Washington, D.C.  
20415.

## Earth Sciences

The earth sciences are concerned with the history, composition, and characteristics of the earth's land, water, interior, atmosphere, and its

environment in space. A large group of the scientists in this field explore for new sources of mineral fuels and ores. Some scientists perform basic research to increase scientific knowledge. Others are involved mainly with applied research, using the knowledge gained from basic research to solve practical problems. Meteorologists, for example, apply scientific knowledge of the atmosphere to forecast weather conditions for specific localities and times. Some earth scientists teach in colleges and universities. They may also administer scientific programs and operations.

Many earth scientists specialize in one particular branch of their broad occupational field. Geophysicists, for example, may be specialists in hydrology, seismology, or physical oceanography. This chapter discusses the specialties and the employment outlook for the four major earth science occupations—geologist, geophysicist, meteorologist, and oceanographer.

## GEOLOGISTS

(D.O.T. 024.081)

### Nature of Work

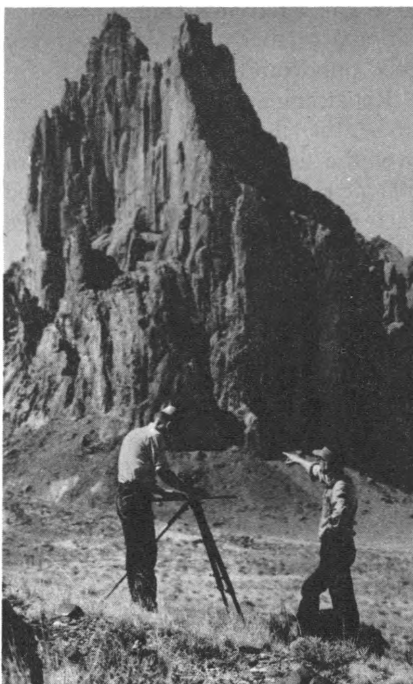
Geologists study the structure, composition, and history of the earth's crust. Many geologists spend a large amount of their time in field work. They study rock cores and cuttings from deep holes drilled into the earth and examine rocks, minerals, and fossils found at or near the surface of the earth. Geologists also spend considerable time in laboratories, where they study geological specimens, analyze geological materials under controlled temperature and pressure, and do other research on geological processes. To present the results of their field and laboratory investigations, geologists prepare reports, articles, and maps of surface and subsurface geological phenomena. In their work, geologists use a variety of complex instruments, such

as the X-ray diffractometer, which determines the structure of minerals, and the petrographic microscope, which permits close study of how rocks have been formed and modified by earth processes.

Some geologists administer research and exploration programs. Others teach in colleges and universities, where they may also work on research projects.

Geologists usually specialize in one branch of the science. *Economic geologists* find and supervise the development of mineral and fuel resources. *Petroleum geologists* specialize in the discovery and recovery of oil and natural gas. *Engineering geologists* apply geological knowledge to engineering problems in the construction of roads, airfields, tunnels, dams, harbors, and other large structures. *Stratigraphers* study the distribution and relative arrangement of sedimentary rock layers by analyzing their fossil and mineral content. *Sedimentologists* determine the processes and products involved in the formation of sedimentary rocks, and *paleontologists* identify, classify, and determine the significance of fossils found within the sediments. *Petrologists* classify and determine the origins of rock masses. *Mineralogists* examine, analyze, and classify minerals and precious stones according to their composition and structure. *Geomorphologists* study the form of the earth's surface and the forces, such as erosion and glaciation, which change it.

Increasing numbers of geologists specialize in new fields that require a detailed knowledge of both geology and one or more other sciences. Among these specialists are *geochemists*, who study the chemical composition of and the changes in minerals and rocks, and *astrogeologists*, who use knowledge of the earth's geology in studies of surface conditions on the moon and the planets. *Geological oceanographers* study the sedimentary and other rocks on the ocean floor and continental shelf. (See statement on Oceanographers elsewhere in this chapter.)



Geologists use plane table and alidade in geologic mapping.

### Where Employed

About 15,000 geologists were employed in the United States in early 1967; only about 3 percent were women. The majority of all geologists worked for private industry. Petroleum and natural gas producers employed most of this group of scientists, chiefly in the States of Texas, California, Louisiana, Colorado, and Oklahoma. Some employees of American petroleum companies worked in foreign countries. Geologists also were employed by companies engaged in mining. Other geologists provided consulting services on a fee or contract basis to organizations in such fields as construction and public utilities.

Approximately 2,000 geologists were employed by the Federal Government, mostly by the U.S. Geological Survey. Other Federal agencies employing geologists included the Army Corps of Engineers, the Naval Oceanographic Office, the Soil Conservation Service, the Bureau of Mines, and the Bureau of Reclama-

tion. State agencies also employed geologists, some of whom worked on surveys conducted in cooperation with the U.S. Geological Survey. Although a few positions were in foreign countries, the majority of Federal jobs were in the United States.

Colleges and universities employed several thousand geologists. A few worked for nonprofit research institutions and museums.

### Training, Other Qualifications, and Advancement

Young people seeking professional careers in geology should plan to earn an advanced degree. The master's degree is required for beginning research and teaching positions and for many positions in exploration. For advancement in college teaching as well as for high-level research and administrative posts, the Ph. D. degree is usually required. The bachelor's degree is considered adequate training for only a few entry jobs, primarily in exploration work.

About 360 colleges and universities offer the bachelor's degree in geology. In the typical undergraduate curriculum, students devote about a fourth of their time to geology courses, such as historical geology, structural geology, mineralogy, petrology, and invertebrate paleontology. About another third of the work is in mathematics, the related natural sciences—such as physics, geophysics, chemistry, and biology—and in engineering; the remainder is in general academic subjects.

More than 160 colleges and universities award advanced degrees in geology. The student seeking a graduate degree in geology takes advanced courses in geology, with emphasis on the student's area of specialization.

The student planning a career in exploration geology should like outdoor activities and have the physical stamina for geological fieldwork, which frequently involves camping out. However, this is not a requirement, since an increasing amount of the work, formerly done in the field,

is now accomplished by aerial photography. In addition, a growing number of specialties are laboratory-oriented.

### Employment Outlook

Employment opportunities for geologists with advanced degrees are expected to be favorable through the remainder of the 1960's and throughout the 1970's. However, those with the bachelor's degree, including those who rank high in their class, will probably face competition for entry positions, depending largely on the hiring practices of petroleum companies. A number of new graduates with the bachelor's degree may find it necessary to enter semiprofessional positions, such as technician or surveyor. Some may take training to qualify as science teachers in secondary schools, or have to seek other work outside the field of geology.

Private industry is expected to increase its employment of geologists somewhat during the next few years. Domestic petroleum exploration activities, which declined in recent years, are expected to expand in the late 1960's and early 1970's. The nature of exploration activities is such that the need for geologists may vary widely from one year to the next, and the shortrun demand for geologists occasionally exceeds the number of persons available for these activities. Geologists also will be needed to help solve problems related to construction, water supply, and improved methods for locating mineral resources.

Federal agency demand for geologists is expected to grow moderately, primarily in the U.S. Geological Survey. Employment of geologists by colleges and universities will probably rise slightly; the need will be mainly for those with Ph. D. degrees who are capable of performing high-level research.

The demand for earth science teachers in secondary schools is expected to increase very rapidly in the next decade. Geology graduates with only the bachelor's degree, but who

have had additional training in educational methods, should have very good opportunities in this area.

Replacement needs are expected to be the chief source of openings over the next few years. More than 500 new geologists will be required each year to replace those who are promoted to managerial positions or who transfer to other fields, retire, or die.

As world population expands and nations become more industrialized, the demand for petroleum, minerals, and fresh water will rise, and increasing numbers of geologists will be required to locate these resources. Geologists will be needed to devise techniques for exploring deeper within the earth's crust, both on land and under the sea, and to work with engineers to develop more efficient methods of recovering natural resources. Space-age activities will require some geologists to analyze data on the surface conditions of the moon and the planets.

Although fieldwork positions usually are considered unsuitable or unattractive to them, most well-qualified women with advanced degrees in geology will be able to find teaching, laboratory, or office positions in this profession.

### Earnings and Working Conditions

Annual starting salaries for new geology graduates with bachelor's degrees averaged between \$7,000 and \$7,300 in private industry in 1966, according to the limited information available. New graduates with master's degrees usually started at between \$1,000 and \$1,500 more a year than those with the bachelor's degree. Starting salaries for those with doctor's degrees ranged from \$10,000 to \$12,000 a year.

In the Federal Government, new graduates with bachelor's degrees could begin at either \$5,683 or \$6,877 a year in early 1967, depending on their college records. Those with master's degrees could start at \$6,877

or \$7,696 and those with the Ph. D. degree, at \$9,221 or \$10,927.

In general, salaries of geologists are usually somewhat higher in industry than in Government and educational institutions. However, teachers often supplement their regular salaries with income from research, consulting, or writing activities. Extra allowances are generally paid geologists for work outside the United States.

The work of geologists is often active and sometimes strenuous. Because much of their work is outdoors, geologists may be exposed to all kinds of weather. Many geologists travel a great deal and may do fieldwork away from home for long periods. Their hours of work are often uncertain because their field activities are affected by weather and travel.

### Where To Go for More Information

American Geological Institute,  
1444 N St. NW., Washington, D.C.  
20005.

### GEOPHYSICISTS

(D.O.T. 024.081)

#### Nature of Work

Geophysics is an overall term covering a number of sciences concerned with the composition and physical aspects of the earth—its size and shape, interior, surface, atmosphere, the land and bodies of water on its surface and underground, and the environment of the earth in space. Geophysicists study the earth's physical characteristics, such as its electric, magnetic, and gravitational fields; the earth's interior heat flow and vibrations; and solar radiation. To conduct their investigations, geophysicists apply the principles and techniques of physics, geology, meteorology, oceanography, geodesy, mathematics, chemistry, and engineering. They use many instruments, including highly complex precision ones such as the seismograph, which measures and records

the transmission time and magnitude of vibrations through the earth; the magnetometer, which measures variations in the earth's magnetic field; and the gravimeter, which measures minute variations in gravitational attraction.

Most *exploration geophysicists* search for oil and mineral deposits. Others conduct research, usually to develop new or improved techniques and instruments for prospecting. *Hydrologists* study the occurrence, circulation, distribution, and physical properties of surface and underground waters in the land areas of the earth. Some hydrologists are concerned with water supplies, irrigation, flood control, and soil erosion. *Seismologists* study the structure of the earth's interior and the vibrations of the earth caused by earthquakes or manmade explosions. They may explore for oil and minerals, provide information for use in designing bridges, dams, and buildings in earthquake regions, or study the problems involved in detecting underground nuclear explosions. *Geodesists* measure the size and shape of the earth, determine the positions and elevations of points on or near the earth's surface, and measure the intensity and direction of the force of gravity. They also help track satellites orbiting in outer space. *Geomagneticians* are concerned with the variations in the earth's magnetic field and with many aspects of space science. *Tectonophysicists* study the structure of mountains and ocean basins, the properties of materials forming the earth's crust, and the physical forces that cause movements and changes in it.

Oceanographers and meteorologists, sometimes classified as geophysical scientists, are discussed separately in this chapter, as is the closely related occupation of geologist.

### Where Employed

About 5,000 geophysicists were employed in the United States in



Geophysicist "patches" 32-inch globe to locate earthquake epicenter.

early 1967. Private industry employed a majority of all geophysicists, chiefly in the petroleum and natural gas industry. Other geophysicists were employed by mining companies, exploration and consulting firms, and research institutions. A few were in business for themselves as consultants and provide services on a fee or contract basis to companies and individuals engaged in prospecting or other activities utilizing geophysical techniques.

Geophysicists in private industry were employed mainly in the southwestern and western sections of the United States, where most of the country's large oil and natural gas fields and mineral deposits are located. Some geophysicists, employed by American firms, are assigned to work in foreign countries for varying periods of time.

Federal Government agencies also employed significant numbers of geophysicists—mainly the U.S. Coast

and Geodetic Survey and the Institute for Earth Sciences of the Environmental Science Services Administration; the U.S. Geological Survey; the Army Map Service; and the Naval Oceanographic Office. Colleges and universities, State governments, and nonprofit research institutions employed small numbers of geophysicists.

### Training, Other Qualifications, and Advancement

A bachelor's degree with a major in geophysics or in one of the geophysical specialties qualifies young persons for many beginning jobs in geophysics. A bachelor's degree in a related science or in engineering, with courses in geophysics, physics, geology, mathematics, chemistry, and engineering, is also adequate preparation for many beginning jobs, especially in geophysical exploration.

For geophysical specialties other than exploration, and for the more responsible positions in exploration work, graduate education in geophysics or in a related physical science is usually required. A doctor's degree with a major in geophysics, or in a related science with advanced courses in geophysics, is generally required for teaching careers. The Ph. D. degree is also frequently required for positions involving fundamental research and for advancement in most types of geophysical work.

The bachelor's degree in geophysics was offered by only about 20 colleges and universities in 1966. These undergraduate programs provide training chiefly in exploration geophysics. Other curriculums that offer the required training for beginning jobs as geophysicists include geophysical technology, geophysical engineering, engineering geology, petroleum geology, and geodesy.

The master's and Ph. D. degrees in geophysics are granted by only a few colleges and universities. For admission to a graduate program, a bachelor's degree with a good background in geology, mathematics, physics, or engineering, or a combination of these subjects is the usual requirement. In general, the graduate student should attend a school in which he can take advanced courses and carry out research projects in the aspect of geophysical science in which he has a special interest.

Beginning geophysicists with only the bachelor's degree are usually given on-the-job training in the application of geophysical principles to their employers' projects. If a new employee has not taken the courses in geophysics needed for his job, he is taught geophysical methods and techniques on the job.

Federal Government agencies also have training programs in which a few geophysicists are sent each year to universities for graduate training. Some Federal Government agencies provide a few summer jobs for promising undergraduates and make permanent positions available to them after graduation.

The prospective geophysicist should be energetic and in excellent health, since geophysicists often have to work outdoors under somewhat rugged conditions. A willingness to travel is also important, since geophysicists may be required to move from place to place in the course of their employment.

### Employment Outlook

Employment opportunities for the few new graduates with degrees in geophysics are expected to be favorable through the 1970's. Opportunities will be best for those with the master's or doctor's degree. There should also be good opportunities in geophysical work for well-qualified people with degrees in other sciences if they have had some formal training in geophysics.

The demand for geophysicists is expected to grow relatively slowly during the remainder of the 1960's and throughout the 1970's. Federal Government agencies will most likely need additional geophysicists for new or expanded geophysical programs. The petroleum and mining industries also will need additional geophysicists for exploration work. However, exploration for oil and mineral deposits is not expected to rise significantly in the next few years. In colleges and universities, employment of teachers of the geophysical sciences will probably show an increase because of the anticipated rise in the number of students majoring in the geophysical sciences. Some geophysicists will also be needed each year to replace those who leave the profession, retire, or die.

Although the number of job openings for geophysicists is not expected to be large in any one year, the number of new graduates with degrees in the science is also expected to be small compared with graduates in other academic fields. As in past years, the number of geophysics graduates who are seeking work as geophysicists will probably be insufficient to meet employers' needs, and well-trained persons with degrees in related sciences

and in engineering will probably continue to be hired for geophysical positions.

Over the long run, further growth in the profession is expected. There will be increasing use of petroleum and mineral products by a growing population. As natural resources in the more easily accessible locations become depleted, additional exploration geophysicists will be needed by petroleum and mining companies to find the more concealed sites of fuels and minerals. In addition, the growing importance of basic research in the geophysical sciences, as well as the continuing need to develop new geophysical techniques and instruments, will create a demand for personnel with advanced training in hydrology, seismology, geodesy, and other geophysical specialties. In Federal Government agencies, additional geophysicists will probably be needed to study the problems of the Nation's water supplies and mineral resources; work on flood control; do research in radioactivity and cosmic and solar radiation; and explore the outer atmosphere and space, using such vehicles as sounding rockets and artificial satellites.

Opportunities for women have been and will continue to be limited, mainly because of the strenuous nature of much of the work. However, a small number of well-qualified women will be able to find positions in offices and laboratories or as teachers in colleges and universities.

### Earnings and Working Conditions

In private industry in 1966, new graduates with bachelor's degrees typically received starting salaries between \$7,000 and \$8,000 a year, according to the limited information available. New graduates with master's degrees received between \$1,000 and \$1,500 more than those with the bachelor's degree. Those with doctor's degrees received salaries of between \$10,000 and \$12,000, depending upon individual qualifications. In industry, geophysical scientists working outside



the United States usually receive bonuses and allowances.

In the Federal Government in early 1967, graduates with bachelor's degrees and no experience could enter most types of geophysical work at either \$6,387 or \$7,729 a year, depending upon their college records. Those who had completed all requirements for the master's degree could start at \$7,729 or \$9,001; those with the Ph. D. degree could start at \$10,481 or \$11,306. In the Federal Government as in industry, geophysicists stationed outside the United States are paid an additional amount.

In educational institutions, starting salaries are generally lower than in private industry or in the Federal Government. University teachers, however, may supplement their income by doing consulting work, writing for scientific publications, or by conducting research.

The work of geophysicists is often active and sometimes strenuous. Exploration geophysicists are subject to reassignment in various locations as exploration activities shift. Their working hours may be irregular and are frequently determined by the requirements of field activities.

### Where To Go for More Information

American Geophysical Union,  
1145 19th St. NW., Washington,  
D.C. 20036.

Society of Exploration Geophysicists,  
Shell Building, Tulsa, Okla. 74119.

## METEOROLOGISTS

(D.O.T. 025.088)

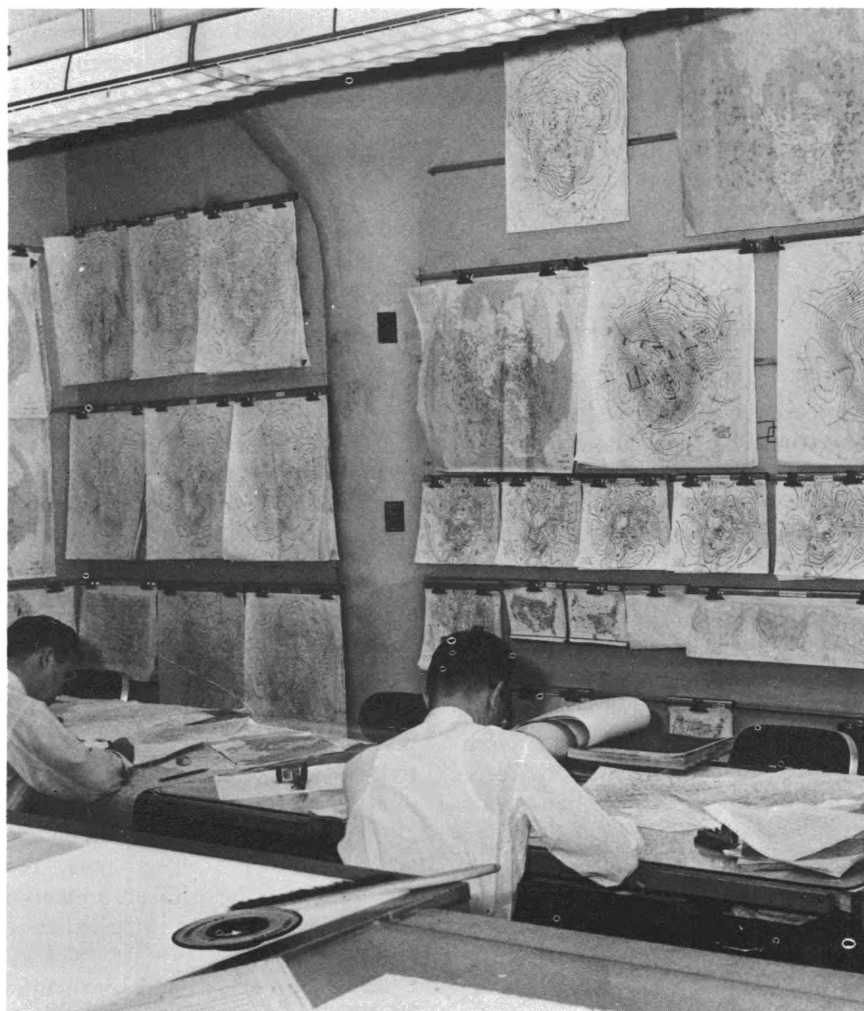
### Nature of Work

Meteorology is the study of atmospheric phenomena—not just of the earth, but of all celestial bodies. Meteorologists attempt to describe and understand the atmosphere's ingredients, motions, processes, and influences. Their knowledge helps solve many practical problems in agricul-

ture, transportation, communications, health, defense, and business.

Meteorologists usually specialize in one branch of the science. Weather forecasters, known professionally as *synoptic meteorologists*, are the largest group of specialists. They interpret current weather information (such as air pressure, temperature, humidity, wind velocity) reported by observers in many parts of the world and by weather satellites to make short- and long-range forecasts for specific regions. *Climatologists* analyze past records on wind, rainfall, sunshine, temperature, and other weather data for a specific area to determine the general pattern of weather which makes up the area's climate. *Dynamic meteorologists* investigate the physical laws governing

atmospheric motions. *Physical meteorologists* study the physical nature of the atmosphere, including its chemical composition and electrical, acoustical, and optical properties, the effect of the atmosphere on the transmission of light, sound, and radio waves, and the factors affecting the formation of clouds, precipitation, and other weather phenomena. *Meteorological instrumentation specialists* develop the devices that measure, record, and evaluate data on atmospheric processes. Specialists in applied meteorology, sometimes called *industrial meteorologists*, study the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they make weather forecasts for individual com-



Meteorologists prepare 5-day forecast of weather conditions.

panies, attempt to induce rain or snow in a given area, and work on such problems as smoke control and air pollution abatement.

Research is the major activity of a growing number of meteorologists. These workers investigate subjects such as atmospheric electricity (for example, lightning), cloud and precipitation mechanisms, hurricane dynamics, and the best and quickest means of using the vast amount of weather data collected from weather satellites. They may also conduct research on severe weather phenomena (such as tornadoes), ways to modify weather, weather conditions affecting the behavior of forest fires, and other problems. In both weather forecasting and research, meteorologists use high-speed electronic computing machines to process large amounts of data.

A number of meteorologists teach or do research—frequently combining the two activities—in universities or colleges. In colleges without separate departments of meteorology, they may teach geography, mathematics, physics, chemistry, or geology, as well as meteorology.

### Where Employed

About 3,500 civilian meteorologists were employed in the United States in early 1967; only about 2 percent were women. The Environmental Science Services Administration (ESSA), which includes the Weather Bureau, employed by far the largest number of civilian meteorologists—nearly 2,000—at 300 stations in all parts of the United States, the polar regions, Puerto Rico, Wake Island, and other Pacific area sites. A few worked for other Federal Government agencies. The Armed Forces employed about 300 civilian professional meteorologists, chiefly in research and development work.

More than 600 meteorologists worked for private industry. Commercial airlines employed about half of these to forecast weather along flight routes and to brief pilots on atmospheric conditions. Others worked

for private weather consulting firms, which provided special weather information for a fee, and for companies that designed and manufactured meteorological instruments. A few worked for large firms in aerospace, insurance, utilities, and other industries.

Colleges and universities employed more than 500 meteorologists in teaching and research activities. Still others worked for State and local governments and for nonprofit organizations.

In addition to these civilian meteorologists, nearly 3,500 members of the Armed Forces were engaged in meteorological work in early 1967. Of these, approximately 3,000 were on active duty in the Air Force. Armed Forces meteorological personnel usually prepare the weather forecasts needed to plan military operations; some also do research.

### Training, Other Qualifications, and Advancement

A bachelor's degree with a major in meteorology is the usual minimum educational requirement for beginning meteorologists in weather forecasting. However, a bachelor's degree in a related science or in engineering is acceptable for many positions, provided the applicant has credit for courses in meteorology. For example, the Federal Government's minimum requirement for beginning positions is a bachelor's degree with at least 20 semester hours of study in meteorology and with additional training in physics and mathematics.

For research and teaching positions and for many top-level positions in other meteorological activities, an advanced degree is essential, preferably in meteorology, although persons with graduate degrees in other sciences may also qualify if they have taken advanced meteorology, physics, mathematics, and chemistry.

About 35 colleges and universities in 1966 offered degree-credit programs in meteorology or a closely re-

lated field. Many other institutions offered courses in meteorology.

Meteorology training is also given by the Armed Forces. For example, each year the U.S. Air Force selects about 200 new college graduates who have received Air Force commissions and sends them to civilian universities for special 9- to 12-month programs in meteorology. Graduates of these programs are then assigned to meteorological work for the Air Force. The Armed Forces also send a number of military meteorologists to universities or to military training centers for advanced training. Ex-servicemen with military training and experience as meteorologists are frequently highly qualified for civilian meteorologist positions, not only with the Armed Forces but for positions with other employers as well.

The ESSA has an in-service training program under which some of its meteorologists are attending college for advanced or specialized training. Some college students preparing for careers in meteorology may obtain summer jobs with this agency. Promotions for regular full-time employees are made according to U.S. Civil Service Commission regulations. (See chapter on Occupations in Government.)

Airline meteorologists have somewhat limited opportunities for advancement. However, after considerable work experience, they may advance to flight dispatcher, or to various supervisory or administrative positions. A few well-trained meteorologists with a background in science, engineering, and business administration may establish their own weather consulting services.

### Employment Outlook

Employment opportunities for meteorologists are expected to be good through the 1970's. Meteorologists with advanced degrees will be in special demand to conduct research, teach in colleges and universities, and engage in management and consulting work. The advent of missiles, su-

personic aircraft, manned spacecraft, and weather satellites has greatly expanded the boundaries of meteorology and opened new fields of activity. Opportunities to study weather on a global scale will be particularly good for meteorologists who can process, analyze, and interpret information obtained by spacecraft and weather satellites. Growth will also stem from the demand for meteorologists to develop and improve instruments, such as radar and radio probes, high altitude balloons, research rockets, satellites, and electronic computers used for collecting and processing weather data. In addition, there will be a continuing demand for meteorologists to work in existing programs, such as weather measurements and forecasts, severe storm research, storm and flood forecasts, turbulence research, and air pollution research. Replacement of meteorologists who retire or leave the profession will also provide some opportunities.

As more jet planes are placed in service and the number of aircraft flights increase, more meteorologists will be needed to assist in determining the safest and smoothest flight routes. Employment opportunities for meteorologists with other private companies and weather consulting services are also expected to increase somewhat, as the value of weather information receives further recognition. This recognition also may create opportunities in research positions with private research organizations and colleges and universities. The number of teaching positions for meteorologists should also rise, primarily because of increases in total college enrollments and increases in departments awarding degrees in meteorology. Opportunities for civilian meteorologists in the Armed Forces are not expected to increase significantly through the 1970's, although there will probably be a growing need for military meteorologists to replace those reaching retirement age.

Since meteorology is a relatively small profession, job openings will not be numerous in any year. On the other hand, qualified applicants for jobs as meteorologists probably will continue to be small. Furthermore, only a few graduates with majors in other fields and with some training in meteorology enter the profession because of opportunities in other scientific fields. In addition, most military meteorological personnel who leave the Armed Forces do not take positions as civilian meteorologists.

### Earnings and Working Conditions

In early 1967, meteorologists with the bachelor's degree and no experience could start in Federal Government service at \$6,387 or \$7,729 a year depending on their college records. Meteorologists who had completed all requirements for the master's degree could start at \$7,729 or \$9,001; those with the Ph.D. degree could begin at \$10,481 or \$11,306. Workers stationed outside the United States were paid an additional amount. Employee benefits for Federal Government meteorologists are the same as for other civil service workers. (See chapter on Occupations in Government.)

Airline meteorologists received a starting salary of approximately \$8,000 a year in early 1967, according to the Air Transport Association. Meteorologists generally receive the same benefits as other airline employees. (See chapter on Occupations in Civil Aviation.)

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of meteorologists in 1966 was \$11,700. Only 10 percent of the meteorologists earned less than \$8,200 and about 10 percent earned more than \$18,000.

Jobs in weather stations, which are operated on a 24-hour, 7-day week basis, often involve nightwork and rotating shifts. Most stations are at airports or at places in or near cities; some are in isolated and remote areas.

### Where To Go for More Information

General information on the field of meteorology—including career opportunities, earnings, professional training—may be obtained from:

American Meteorological Society,  
45 Beacon St., Boston, Mass. 02108.

American Geophysical Union,  
1145 19th St. NW., Washington,  
D.C. 20036.

Information on employment opportunities with the U.S. Weather Bureau and on its student-assistance program may be obtained from:

Environmental Science Services Administration,  
Washington Science Center, Rockville, Md. 20852.

Information on the Air Force meteorological training programs may be obtained from the nearest USAF recruiting office or from:

Commander, USAF Recruiting Service,  
Wright-Patterson AFB, Ohio 45899.

### OCEANOGRAPHERS

(D.O.T. 024.081 and 041.081)

#### Nature of Work

The ocean, which covers more than two-thirds of the earth's surface, provides valuable foods and minerals, influences the weather, serves as a "highway" for transportation, and offers many varieties of recreation. Oceanographers study the ocean—its characteristics, movements, physical properties, and plant and animal life. The results of their studies not only extend basic scientific knowledge, but contribute to the development of practical methods for use in such operations as forecasting weather, improving fisheries, mining ocean resources, and defending the Nation.

Oceanographers plan extensive tests and observational programs and conduct detailed surveys and experiments to obtain information about the ocean. They may collect and study data on the ocean's tides, cur-



Oceanographers examine contents of plankton net.

rents, and waves; its temperature, density, and acoustical properties; its sediments; its subbottom; its shape; its interaction with the atmosphere; and marine plants and animals. They analyze the samples, specimens, and data collected, often using electronic computers. To present the results of their studies, they prepare maps and charts, tabulations, reports, and manuals, and write papers for scientific journals.

In developing and carrying out tests and observational programs, oceanographers use the principles and techniques of the natural sciences, mathematics, and engineering. They use a variety of special instruments and devices that measure the earth's magnetic and gravity fields, the speed of sound traveling through water, the oceans' depths, the flow of heat from the earth's interior, and the temperature and chemical composition of the water. Specially developed cameras with strong lights enable oceanographers to photograph marine organisms and the ocean floor; new research vehicles transport marine scientists to the floor of the sea. When their work requires new oceanographic instruments or analytical techniques, they usually develop them.

Most oceanographers are specialists in one of the branches of the profession. *Biological oceanographers* (marine biologists) study the ocean's plant and animal life, and the environmental conditions affecting them. *Physical oceanographers* (physicists and geophysicists) study the physical properties of the ocean, such as its density, temperature, and ability to transmit light and sound; the movements of the sea; and the relationship between the sea and the atmosphere. *Geological oceanographers* (marine geologists) study the topographic features, rocks, and sediments of the ocean floor. *Chemical oceanographers* investigate the chemical composition of ocean water and sediments, and chemical reactions that take place in the sea. *Marine meteorologists* study the interaction of the atmosphere and the ocean, and the processes by which weather over the ocean is generated. *Oceanographic engineers* and *electronic specialists* design and build the systems, devices, and instruments used in oceanographic research and operations.

About 3 out of every 4 oceanographers are engaged primarily in performing or administering research and development activities. A number of oceanographers teach in colleges and universities; a few are engaged in technical writing, consulting, and in the administration of activities other than research.

Most oceanographers spend at least part of their time aboard oceanographic ships at sea. Such voyages may last from a few days to several months. A few oceanographers in survey positions spend nearly all their time aboard ship. On the other hand, some oceanographers never go to sea, but analyze data collected by other scientists or pursue mathematical or theoretical studies ashore.

### Where Employed

Oceanography is one of the smallest of science fields; the total number of oceanographers and closely related

scientists in the United States was estimated to be approximately 3,000 in early 1967. About three-fourths of these were employed by colleges and universities, research laboratories, and the Federal Government. Those Federal agencies employing substantial numbers of oceanographers were the Naval Oceanographic Office, Department of the Navy; the Bureau of Commercial Fisheries, Department of the Interior; and the Institute for Oceanography, and the U.S. Coast and Geodetic Survey of the Environmental Science Services Administration, Department of Commerce. There also were a few positions in oceanography in other Government agencies.

A growing number of oceanographers worked in private industry for consulting or other firms that design and develop instruments and vehicles for oceanographic research. A few worked for fishery laboratories of State and local governments.

### Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning professional positions in oceanography is the bachelor's degree with a major in oceanography, biology, a geo-science, one of the other basic sciences, mathematics, or engineering. For professional positions in research and teaching and for advancement to high-level positions in most types of work, graduate training in oceanography or one of the basic sciences is usually required.

Undergraduate training in oceanography and marine science was offered by only a few colleges and universities in 1966, and only about five institutions offered the bachelor's degree with a major in oceanography. However, since oceanography is an interdisciplinary field, training in the related basic sciences, when coupled with a strong interest in oceanography, is adequate preparation for

most beginning positions in the field, or for entry into graduate school.

Important undergraduate courses for the prospective oceanographer are in the fields of mathematics, physics, chemistry, geophysics, geology, meteorology, and biology. In general, the student should specialize in the particular science field which is closest to his area of interest in oceanography. For example, students interested in chemical oceanography should obtain a degree in chemistry.

In 1966, about 15 colleges and universities offered advanced degrees in oceanography, and about 30 other institutions offered advanced courses in the marine sciences or oceanographic engineering. The academic work of the graduate student in oceanography consists primarily of extensive training in a basic science combined with further training in oceanography. The graduate student usually spends part of his time aboard ship—doing oceanographic research for his dissertation, and at the same time acquiring familiarity with the sea and the techniques used to obtain oceanographic information.

The beginning oceanographer with the bachelor's degree usually starts as a research or laboratory assistant, or in a position involving routine data collection, analysis, or computation. Most new oceanographers receive on-the-job training related to the specific work at hand. The nature and extent of the training given vary with the background and needs of the individual. Thus, the new graduate who has a degree in a basic science rather than in oceanography usually can be provided enough understanding of oceanographic principles to enable him to perform adequately in this field.

Beginning oceanographers with advanced degrees usually can qualify for research and teaching positions. Experienced oceanographers may be selected for administrative positions, in which they may supervise a research laboratory or direct specific survey or research projects.

### Employment Outlook

Employment opportunities in oceanography are expected to be good through the 1970's. Those with advanced degrees will have the best opportunities for employment. Well-trained persons with bachelor's degrees in related sciences will find opportunities mainly as research assistants in routine analytical positions.

The outlook is for rapid growth of this small profession, both during the late 1960's and through the 1970's. Growing recognition of the importance of the oceans to the Nation's welfare and security has heightened interest in oceanography and has opened new fields for specialists. In the years ahead, oceanographers will be needed for research in such areas as underwater acoustics, surface and subsurface ocean currents, and ocean floor topography, all of which are important in improving the Nation's defense against submarines and surface vessels. There also will be a demand for oceanographers to supply weather and iceberg forecasts; to study air-sea interaction in order to improve long-range weather forecasts; to solve sea mining problems; and to predict, control, and prevent pollution and damage caused by waves and tides. Other oceanographers will be needed to improve methods of deriving foods from the oceans, to manage fisheries, and to develop economical ways to harness the ocean for energy and to increase the supply of fresh water.

The demand for oceanographers qualified to teach in colleges and universities also is expected to expand. As interest in oceanography grows and more courses in oceanography are offered, more teachers in the science will be needed.

Replacement of oceanographers who transfer to other fields, retire, or die will also provide some opportunities.

Since oceanography is a relatively small profession, job openings will not be numerous in any one year. On the other hand, the number of new

graduates with degrees in this science is extremely small and is expected to remain so. Thus, new oceanography graduates should continue to have excellent opportunities.

Recent improvements in the facilities and living quarters aboard oceanographic ships will expand the opportunities for women in oceanography.

### Earnings and Working Conditions

In the Federal Government service in early 1967, oceanographers with the bachelor's degree and no experience could begin at \$6,387 or \$7,729 a year, depending on their college records. Beginning oceanographers who had completed all requirements for the master's degree could start at \$7,729 or \$9,001; those with the Ph. D. degree could begin at \$10,481 or \$11,306. Scientists in biological and geological specialties had somewhat lower starting salaries.

Beginning oceanographers in educational institutions receive the same salary as other beginning faculty members. (See statement on College and University Teachers.) In addition to their regular salaries, many experienced oceanographers in educational institutions earn extra income from consulting, lecturing, and writing activities.

Oceanographers engaged in research requiring sea voyages are frequently away from home for weeks or months at a time, sometimes living and working in cramped quarters. Young people who like the sea, however, may find these voyages very satisfying.

### Where To Go for More Information

General information about oceanography—including career opportunities, professional training, colleges and universities with applicable degree-credit programs, earnings, and the economic significance of ocean-

ographic activities—may be obtained from:

American Society for Oceanography,  
906 C. & I. Bldg., Houston, Tex.  
77002.

American Society of Limnology and  
Oceanography,  
Institute of Ecology,  
University of California, Davis,  
Calif. 95616.

Interagency Committee on Oceanog-  
raphy,  
Bldg. 159E, Washington Navy Yard,  
Washington, D.C. 20390.

International Oceanographic Foun-  
dation,  
1 Rickenbacker Causeway, Virginia  
Key, Miami, Fla. 33149.

National Oceanographic Association,  
1900 L St. NW., Washington, D.C.  
20036.

Federal Government career infor-  
mation may be obtained from any re-  
gional office of the U.S. Civil Service  
Commission or from:

Interagency Board of U.S. Civil Ser-  
vice Examiners for Washington,  
D.C.,  
1900 E St. NW., Washington, D.C.  
20415.

Some information on oceano-  
graphic specialties may be obtained  
from professional societies listed else-  
where in the *Handbook*. (See state-  
ments on Geologists, Geophysicists,  
Biological Scientists, Meteorologists,  
and Chemists.)

The booklet *Oceanography Infor-  
mation Sources* lists the names and  
addresses of many professional, re-  
search, and industrial organizations  
interested in oceanography. Copies,  
priced at \$1.50 each, may be pur-  
chased from:

Printing and Publishing Office,  
National Academy of Sciences,  
2101 Constitution Ave. NW., Wash-  
ington, D.C. 20418.

## Physical Sciences

The physical sciences deal with the  
basic laws of the physical world.  
Many physical scientists conduct

basic research designed to increase  
man's knowledge of the properties of  
matter and energy. Others conduct  
applied research, using the knowl-  
edge gained from basic research to  
develop new products and processes.  
For example, chemists in applied re-  
search use their knowledge of the in-  
teractions of various chemicals to  
develop new fuels for rockets and  
missiles. Physical scientists also teach  
in colleges and universities and  
supervise research and development  
programs.

This chapter includes descriptions  
of three major physical science oc-  
cupations—chemist, physicist, and  
astronomer—and of biochemists, one  
of the major groups of chemists. En-  
gineers and earth scientists also re-  
quire a background in the physical  
sciences; these occupations are de-  
scribed in separate chapters else-  
where in the *Handbook*.

## CHEMISTS

(D.O.T. 022.081, .168, .181, and .281)

### Nature of Work

The clothes we wear, the food we  
eat, the houses in which we live—in  
fact, most of the things which help  
to make our lives more comfortable,  
healthy, and productive—have re-  
sulted, in part, from the chemist's  
continuing search for new knowledge.  
Although the day-to-day activities of  
chemists generally receive little notice,  
some of their discoveries have led to  
the creation of whole new industries,  
such as the plastics, frozen foods, and  
manmade fibers industries.

Chemists investigate the properties  
and composition of matter, and the  
the laws that govern the combination  
of elements in a seemingly endless  
variety of forms. They search for new  
knowledge concerning the nature of  
substances and for ways of putting  
this knowledge to practical use. In  
conducting studies, they apply scien-  
tific principles and techniques, using  
a variety of specialized instruments

to measure, identify, and evaluate  
changes in matter. Chemists maintain  
accurate records of their work and  
prepare clear and concise reports  
showing the results of the tests or ex-  
periments. They often present their  
findings in scientific publications or  
in lectures before scientific groups.

Most chemists specialize in one of  
five major branches of chemistry, or  
in a subdivision of one of these  
branches. *Organic chemists*, the larg-  
est group, deal primarily with carbon  
compounds, most of which are sub-  
stances originally derived from ani-  
mal and vegetable matter. *Inorganic  
chemists* are chiefly concerned with  
substances that do not contain carbon,  
such as the metals and most minerals.  
*Physical chemists* study the quanti-  
tative relationships between chemi-  
cal and physical properties of both  
organic and inorganic substances—  
for example, how these substances are  
affected by electricity, pressure, heat,  
and radiation. *Analytical chemists*  
determine the chemical composition  
of substances and perform tests to  
determine quality, purity, and other  
characteristics. *Biochemists* are con-  
cerned with the chemistry of living  
things. (See separate statement on  
Biochemists elsewhere in this chap-  
ter.)

Some chemists specialize in the  
product or process of a particular in-  
dustry, such as agriculture, food,  
petroleum, plastics, or rubber. Such  
work may require a knowledge of  
more than one branch of chemistry.  
The specialist in plastics, for example,  
may need a knowledge of physical  
and analytical as well as of organic  
chemistry. All chemists, however,  
must know the fundamentals of  
chemistry—the composition and  
properties of substances and how they  
can be changed.

Nearly one-half of all chemists are  
engaged in research and development.  
Many research chemists work on ap-  
plied research projects aimed at creat-  
ing new products or improving or  
finding new uses for existing ones.  
Chemists in applied research have  
helped to develop a vast range of new  
products, including antibiotics, plas-

tics, synthetic rubbers, detergents, insecticides and manmade fibers. Many other chemists work on basic research projects designed to extend scientific knowledge rather than to solve immediate practical problems. Knowledge resulting from basic research frequently has immediate application to practical problems. For example, basic research on polymerization—how and why small molecules unite to form giant molecules—resulted in the development of synthetic rubber, nylon, and plastics.

More than one-fifth of all chemists are employed in management and administration—especially of research and development activities. A smaller proportion of chemists devote most of their time to teaching, often combining research with teaching. Analysis and testing is another major activity of chemists because various kinds of tests must be made at practically every stage in the manufacture of a product, from initial development to final production. Others are employed as marketing experts or sales representatives of chemical companies and other manufacturers in positions where the employee must be familiar with the technical aspects of products. Some chemists work as private consultants to private industry firms and government agencies.

### Where Employed

Chemistry is by far the largest field of employment in the physical sciences. There were approximately 122,000 chemists employed in the United States in early 1967; more than 5 percent were women.

Nearly two-thirds of all chemists were employed by private industry in early 1967. The major industrial employer of chemists, the chemicals manufacturing industry, employed more than two-fifths of the chemists in private industry. Relatively large numbers of other chemists were found in the industries manufacturing food, petroleum, paper, electrical equipment, and primary metals products.



Chemist identifies absorption bands with infrared spectrometer.

Significant numbers of chemists also were employed by distributors of chemical, pharmaceutical, food, and petroleum products; and by independent laboratories and research institutes providing consulting services.

About one-fifth of all chemists were employed by colleges and universities. A smaller number of research chemists worked for foundations and other nonprofit organizations. A number of chemists were employed by Federal Government agencies, chiefly by the U.S. Departments of Defense;

Health, Education, and Welfare; Agriculture; and Interior. Small numbers worked for State and local governments, primarily in agencies concerned with health or agriculture.

Chemists were employed in all States, in small as well as large cities. However, they were usually concentrated in large industrial areas. In 1966, nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half of the total worked in the six States of New

York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

### Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry is usually the minimum educational requirement for starting a career as a chemist. Graduate training is essential for many positions, particularly in research and college teaching, and is helpful for advancement in all types of work.

Training leading to the bachelor's degree in chemistry is offered by more than 900 colleges and universities throughout the country. In addition to the required chemistry courses in inorganic, organic, and physical chemistry, and quantitative and qualitative analysis, the undergraduate chemistry major also takes courses in mathematics (especially analytical geometry and calculus) and physics.

Advanced degrees in chemistry are awarded by nearly 300 colleges and universities, many of which offer financial assistance to students interested in graduate study. In graduate school, the student usually specializes by taking several courses in a particular field of chemistry. Requirements for the master's or doctor's degree vary by institution but usually include lectures, laboratory work and thesis preparation.

New graduates with the bachelor's degree usually qualify for beginning positions in analysis and testing, quality control, technical service and sales, or as assistants to senior chemists in research and development work. Most chemists with only the bachelor's degree start their careers in industry or government. In industry, employers often have special training programs for new chemistry graduates whom they employ. These programs are designed to supplement college training with specific industry techniques and to aid in determining the type of work for which the new employee is best suited. Some chemists with the bachelor's degree obtain positions in colleges and universities

as research or teaching assistants while working toward advanced degrees. They may also qualify as secondary school teachers.

Chemists with the master's degree often qualify for applied research positions in government or private industry. They can also qualify for some teaching positions in colleges and universities and in 2-year colleges.

The Ph. D. degree is generally required for positions in basic research and for higher level faculty positions in a college or university. It is also important for advancement to top-level positions in administration and in other activities.

### Employment Outlook

The employment outlook for chemists is expected to be very good through the remainder of the 1960's and the 1970's. As in recent years, there will be a particular need for chemists with advanced degrees for research and teaching positions. For women chemists qualified to do research and teaching, employment opportunities are also expected to be increasingly good.

One of the major factors behind the expected increase in employment opportunities is the anticipated continued growth in expenditures for research and development. Such expenditures not only create jobs for chemists engaged in research and development—the activity of nearly half of all chemists—but the production of new products resulting from the research also creates new positions for chemists in other types of work. Another important factor involved in increasing the opportunities for chemists is the growing demand for products of industries that are major employers of chemists, especially for such products as plastics, manmade fibers, drugs, fertilizers, and high energy and nuclear fuels for missiles and rockets.

The demand for chemists to fill college and university teaching positions will also rise substantially, because of the large increases in college

enrollments expected during the late 1960's and throughout the 1970's. The greatest demand will be for those with Ph. D. degrees, but there will be many positions for chemists with the master's degree, especially in 2-year colleges. (See statement on College and University Teachers.)

In addition to those needed to fill new positions, many chemists also will be needed each year to replace those who retire, die, or transfer to other occupations. These losses to the profession will average approximately 4,200 annually.

Along with the expected growth in demand for chemists, a steady increase is expected in the number of chemistry graduates. If their numbers continue to represent the same proportion of all college graduates as in recent years, the numbers seeking employment in the profession will rise rapidly throughout the 1970's. Nevertheless, the demand for chemists is expected to be greater than the number of new graduates who will be available for employment. Thus, although there may be some competition for the better paying entry positions, new chemistry graduates should continue to have very favorable employment opportunities in the profession. New graduates will also find openings in high school teaching, provided they have completed the professional education courses and other requirements for a State teaching certificate. However, they are usually regarded as teachers rather than as chemists. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

### Earnings and Working Conditions

Inexperienced chemistry graduates with a bachelor's degree had an average (median) starting salary of about \$7,500 a year in private industry in 1966, according to a survey conducted by the American Chemical Society. Inexperienced graduates with the master's degree averaged about \$8,900 a year and those with the Ph. D. degree, about \$12,500.



In academic institutions, the average (median) annual starting salary for the few entrants with the bachelor's degree and no experience was about \$5,600, according to the American Chemical Society. The average salary for inexperienced graduates with the master's degree was about \$7,200, and for those with the Ph. D. degree, \$10,000. Many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing books.

In Federal Government positions in early 1967, the annual starting salary for inexperienced chemists with the bachelor's degree was either \$6,387 or \$7,729, depending on the individual's college record. Beginning chemists with 1 year of graduate study could start at \$7,729 and those with 2 years of graduate study at \$9,001. Chemists with the Ph. D. degree could start at \$10,481 or \$11,306.

The average (median) annual salary for all chemists was \$12,000 in 1966, according to the National Science Foundation's National Register of Scientific and Technical Personnel. Only 10 percent of all chemists earned less than \$7,800 a year, and about 10 percent earned \$19,000 or more.

Chemists spend most of their time working in modern, well-equipped, well-lighted laboratories, offices, or classrooms. Chemists work with chemicals that can be dangerous if handled carelessly. However, when safety regulations are followed, health hazards are negligible.

### Where To Go for More Information

American Chemical Society,  
1155 16th St. NW., Washington,  
D.C. 20036.

Manufacturing Chemists' Association,  
Inc.  
1825 Connecticut Ave. NW., Wash-  
ington, D.C. 20009.

For additional sources of information, see also statements on Biochemists, Chemical Engineers, and Industrial Chemical Industry.

## BIOCHEMISTS

(D.O.T. 041.081)

### Nature of Work

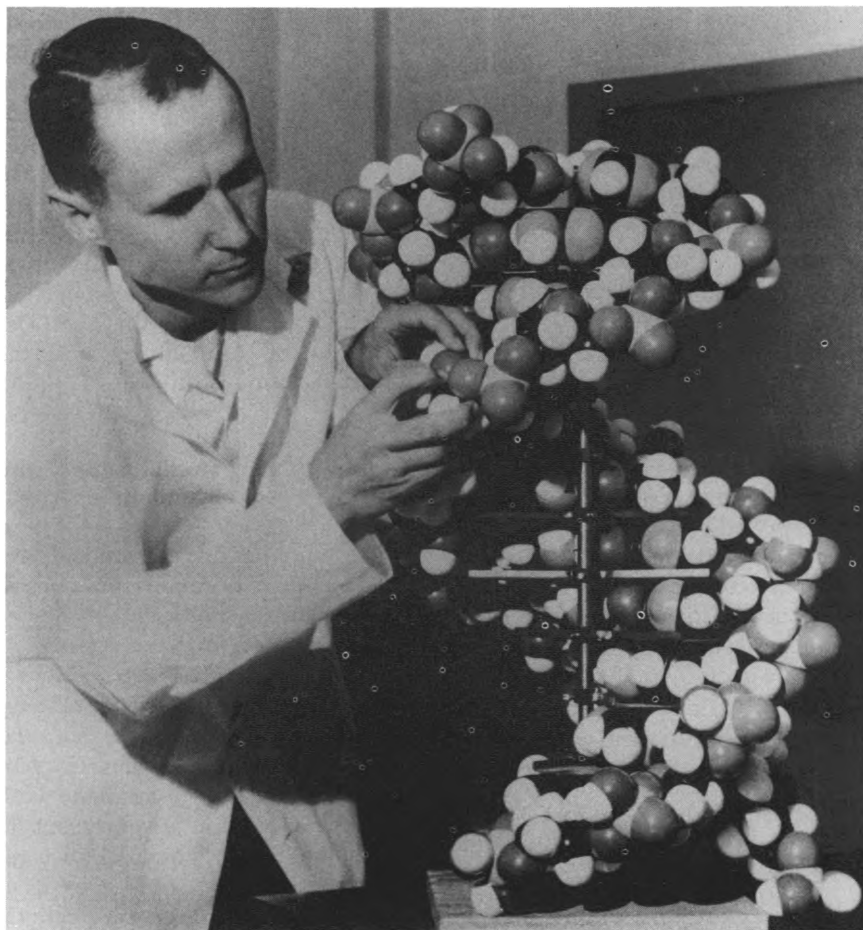
The biochemist plays an important role in modern science's research for the basis of life and the factors that sustain life. His professional interests range from what determines heredity to how living things react to space travel.

Biochemists study the chemical composition of living organisms. They identify and analyze the chemical processes related to biological functions, such as muscular contraction, reproduction, and metabolism. Biochemists investigate the effects on organisms of such chemical substances as foods, hormones, and drugs.

They study the chemical changes in living tissue caused by genetic and environmental factors.

Biochemists work with a wide variety of substances, ranging from very small molecules to giant macromolecules. They study such chemical compounds as minerals, sugars, amino acids, proteins, polysaccharides, nucleic acids, fats, and steroids. Biochemists deal with problems in genetics, enzymology, hormone action, bioenergetics, and the phenomena of biochemical control. Studies in all of these areas with all of these kinds of compounds can be directed toward many fields.

Foremost among the areas of application of biochemistry are the fields of medicine, nutrition, and agriculture. In the medical field, biochemists may investigate the causes and cures of disease or develop diag-



Biochemist constructs molecular model.

nostic procedures. In the nutritional field, they may identify the nutrients necessary for the maintenance of good health and the effects of specific deficiencies on various kinds of performance, including the ability to learn. In agriculture, biochemists investigate soils, fertilizers, and plants, undertaking studies to discover more efficient methods of crop cultivation, storage, and utilization, and the design and use of pest-control agents.

Biochemists apply the principles and procedures of chemical and physical analysis to their research problems. They use a variety of scientific instruments and devices, including electron microscopes and radioactive isotope counters, and devise new instruments and analytical techniques as needed. Biochemists usually report the results of their research in scientific journals and sometimes lecture before scientific groups.

The greatest number of biochemists—2 out of every 3—are engaged in research. The emphasis is on basic research designed to increase scientific knowledge. The small group of biochemists working in applied research use the discoveries of basic research to solve practical problems or develop a useful product. For example, through basic research, biochemists discover how a living organism forms a hormone. This knowledge is put to use by synthesizing the hormone in the laboratory and then producing it on a mass scale to enrich hormone-deficient organisms. The distinction between basic and applied research, however, is often one of degree, and it is therefore not unusual for biochemists to be proficient in both types of work.

Some biochemists teach in colleges and universities, often combining research with teaching. Others are engaged in production or testing activities; still others work as consultants.

### Where Employed

Approximately 10,500 biochemists were employed in the United States

in early 1967; about 15 percent were women. Biochemists were employed in both large and small cities, and in all States.

About half of all biochemists were employed by colleges and universities in early 1967. Many of these scientists worked in university-operated laboratories and hospitals where they spent their time in teaching and research. Another 1,500 biochemists worked for nonprofit organizations, such as research institutes and hospitals.

Private industry employed several thousand biochemists. The largest group of these worked in manufacturing industries—primarily the chemicals and food industries. Within the chemicals industry, many biochemists were employed by manufacturers of drugs, insecticides, and cosmetics. A number of biochemists worked for private consulting firms.

More than 1,500 biochemists worked for Federal, State, and local government agencies. Most of these scientists were employed by the Federal Government, chiefly by the National Institutes of Health and the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare; the Agricultural Research Service and regional research laboratories of the U.S. Department of Agriculture; and the Veterans Administration.

### Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in biochemistry is the bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry. For most entrance positions in research and teaching, graduate training in biochemistry is required. Graduate work is also needed for advancement to most high-level positions in all types of work.

Although relatively few schools award the bachelor's degree in biochemistry, training in chemistry is

offered in more than 900 colleges and universities throughout the country. Important undergraduate courses for the prospective biochemist are physical, analytical, organic, and inorganic chemistry; general biology; mathematics; and physics.

Graduate degrees in biochemistry are offered by over 50 colleges and universities. For entrance into a graduate program in biochemistry, schools usually require the student to have a bachelor's degree in biochemistry, chemistry, or biology. However, students with the bachelor's degree in another basic science are usually admitted if they have had several undergraduate courses in chemistry.

In graduate school, the student builds upon the basic knowledge obtained in the undergraduate curriculum. He takes advanced courses and may conduct research in many areas of biochemistry. In the course of completing work for the doctoral degree, he frequently becomes a specialist in a particular field of biochemistry by doing intensive research and writing a thesis.

Some graduate schools with extensive research facilities or a staff highly accomplished in a special field have gained a reputation for training students in that particular field of biochemistry. For example, the colleges affiliated with a medical school or hospital often have the facilities and equipment available for studying the biochemistry of disease. A student who desires to specialize in a particular field of biochemistry should, therefore, investigate the specialties of the various schools and choose his college carefully.

New graduates with the bachelor's degree usually begin work in industry or government as research assistants in positions involving testing and analysis. In the drug manufacturing industry, for example, research assistants may analyze the ingredients of a product to verify and maintain its purity or quality. Some graduate students become research or teaching assistants in colleges and universities.

Beginning biochemists with advanced degrees usually qualify for

teaching and research positions. With experience, some biochemists with the Ph. D. degree advance to high-level administrative positions and supervise research programs. Other highly qualified biochemists, who prefer to devote their time to research, often become leaders in a particular field of biochemistry.

### Employment Outlook

The employment outlook is likely to be very good for biochemists for the remainder of the 1960's and throughout the 1970's. Biochemists with the Ph. D. degree will be in special demand. Their services will be required to conduct independent research and to teach in colleges and universities.

Employment opportunities will stem mainly from the very rapid growth expected in this field. Several hundred positions, however, will have to be filled each year to replace workers who transfer to other fields of work, retire, or die. The major factor underlying the anticipated growth is the continued increase in expenditures for research and development in the life sciences. Such expenditures, which have risen rapidly in recent years, are expected to continue to rise, although at a slower rate.

The greatest growth in employment of biochemists is expected in hospitals, medical clinics, and other places where medical research is conducted. Growth in this area will result chiefly from the expansion of research on such health problems as cancer, heart disease, muscular dystrophy, and mental illness. Biochemistry also is becoming important in other fields, such as oceanography and environmental health (pollution).

Private industry and the Federal Government are also expected to absorb a growing number of workers in the field of biochemistry. Stimulating this employment growth will be the more stringent standards that have been established by the Congress and

Federal regulatory agencies for research on, and testing of, new drugs, chemicals, and processing methods before their use in medicine and agriculture.

Growing college enrollments, especially of students majoring in chemistry and related fields, will strengthen the demand for biochemists qualified to teach in colleges and universities.

Although biochemistry is a relatively small profession and job openings will not be numerous in any one year, the number of graduates with degrees in this science is also fairly small and is expected to remain so. Thus, for biochemistry graduates—women as well as men—the employment outlook should continue to be favorable.

### Earnings

Starting salaries paid to biochemists employed by colleges and universities are comparable to those for other professional faculty members. Biochemists in educational institutions often supplement their income by engaging in outside research or consulting work.

In private industry in 1966, the average annual starting salary of biochemists with the bachelor's degree was about \$7,500, according to the limited information available. Starting salaries for biochemists with the master's degree averaged about \$1,400 more a year than for those with the bachelor's degree. Annual starting salaries of biochemists with the Ph.D. degree ranged from \$7,000 to \$12,500, depending on their specialty and research experience in graduate school.

In the Federal Government in early 1967, beginning biochemists with the bachelor's degree could start at \$6,387 or \$7,729 a year, depending on their college records. Biochemists with the master's degree could start at \$7,729 or \$9,001, and those with the Ph.D. degree at \$10,481 or \$11,306.

### Where To Go for More Information

American Society of Biological Chemists,  
9650 Rockville Pike, Bethesda, Md.  
20014.

### PHYSICISTS

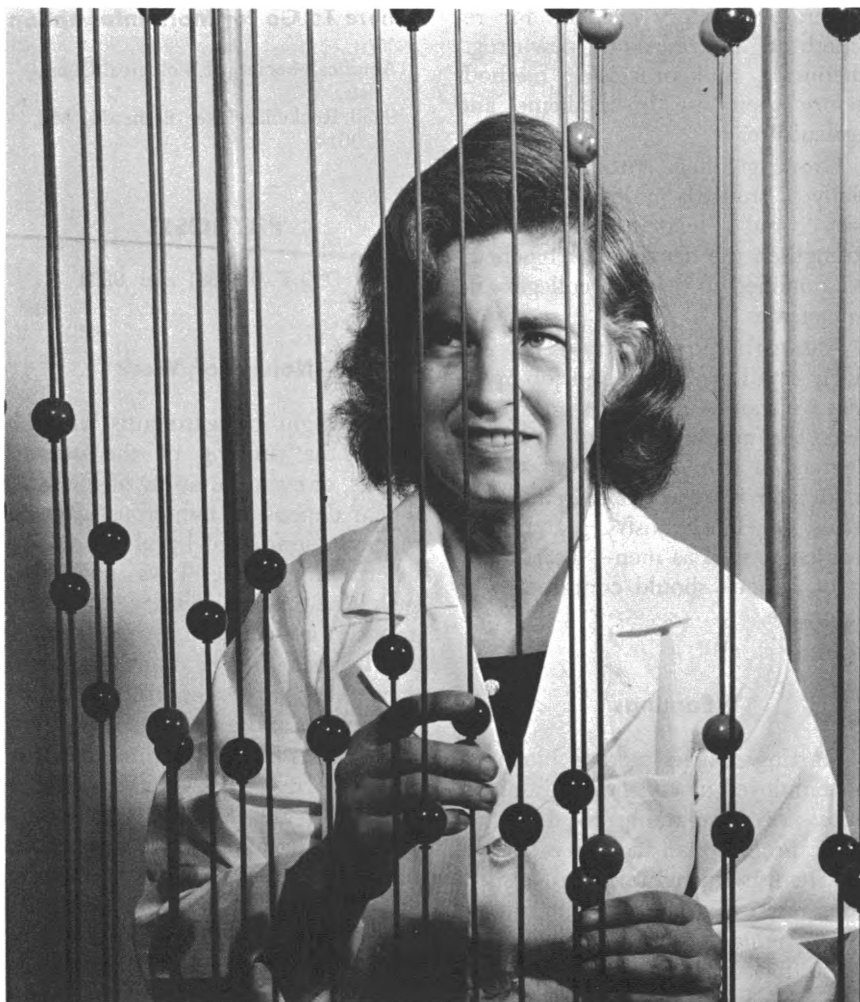
(D.O.T. 023.081 and .088)

#### Nature of Work

The flight of astronauts through space, the probing of the oceans' depths, or even the safety of the family car depend in numerous ways on research performed by physicists. By determining basic laws governing such factors as density, pressure, gravity, acceleration, and friction, and by their interrelationships, problems under various conditions can be anticipated and overcome.

Physicists observe and analyze the various forms of energy, the structure of matter, and the relationship between matter and energy. From their research, physicists develop theories and discover fundamental laws that describe the behavior of the forces at work within the universe. Their studies have continued to broaden man's understanding of the physical world and have enabled him to make increasing use of natural resources. Physicists have made valuable contributions to scientific progress in recent years in such areas as nuclear energy, electronics, communications, and aerospace.

About 1 out of every 2 physicists is engaged in research and development. Many conduct basic research, designed to increase scientific knowledge with only secondary regard to its practical applications. Some of these, called theoretical physicists, attempt to describe the interactions between matter and energy in mathematical terms. Others, called experimental physicists, make careful systematic observations and perform experiments to identify and measure these interactions. For example, they try to identify and measure the life-



Research physicist constructs 3-dimensional model.

time of tiny particles of matter which may exist within the nucleus of the atom. Experimental physicists use apparatus such as particle accelerators, X-ray spectrometers, microwave devices, lasers, and phase and electron microscopes. When their research requires new kinds of instruments, they may design them. The difference between theoretical and experimental physicists is often merely one of emphasis. Some members of the profession are skilled in both types of work.

A large number of physicists who are engineering-oriented engage in applied research. They use the knowledge gained from basic research to solve practical problems or to create new or improved products. For ex-

ample, the work of physicists specializing in solid-state physics led to the development of transistors and microcircuits, now used in place of vacuum tubes in many types of electronic equipment ranging from hearing aids to guidance systems for missiles.

Many physicists teach in colleges and universities, often combining research with teaching. Some are engaged in management and administration, especially of research and development programs. Others work in activities related to the production of industrial products such as inspection and quality control. Some university physicists do part-time consulting work.

Most physicists specialize in one or more branches of the science—

mechanics, thermal phenomena, high energy physics, optics, acoustics, electromagnetism, electronics, atomic and molecular physics, nuclear physics, physics of fluids, solid-state physics, or classical theoretical physics. They may concentrate in a subdivision of one of these branches. For example, within solid-state physics they may specialize in ceramics, crystallography, or semiconductors, among others. In addition, emerging knowledge continually opens new areas of research. For example, the development of lasers and masers had led to new experimentation in optics, and other fields. However, since all physics specialties rest on the same fundamental principles, the physicist's work often overlaps a number of specialties.

Physicists often apply the theories and methodology of their science to problems originating in other sciences, including astronomy, biology, chemistry, and geology. Growing numbers of scientists have become specialists in fields that combine the knowledge of physics and a related science. Thus, a number of specialties have developed on the borderline between physics and other fields—astrophysics, biophysics, chemical physics, and geophysics. (Information on these occupations is contained elsewhere in the *Handbook*.) Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

### Where Employed

Approximately 44,000 physicists were employed in the United States in early 1967. About 18,000 were employed by private industry. More than one-fifth of this group were employed in the electrical equipment industry. Other industries using relatively large numbers of physicists included the ordnance, chemicals, aerospace, and instruments industries and independent commercial laboratories and research institutes. Significant numbers also were employed by the machinery and engineering

and architectural services industries.

In early 1967, colleges and universities employed more than 18,000 teaching and research physicists, a large number of whom combined both activities. Federal Government agencies employed large numbers of physicists—approximately 6,000 in early 1967—mainly in the Department of Defense, the National Bureau of Standards, and the National Aeronautics and Space Administration. Another 1,500 physicists were employed by nonprofit organizations.

Physicists were employed in all States. However, their employment was greatest in those areas having industrial concentrations and large colleges and universities. More than one-fourth of the physicists were employed in four metropolitan areas—Boston, Washington, D.C., Los Angeles—Long Beach, and New York. Nearly one-half of the total were employed in the five States of California, New York, Massachusetts, Pennsylvania, and New Jersey.

Relatively few physicists are women—only about 3 percent, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

### **Training, Other Qualifications, and Advancement**

A bachelor's degree with a major in physics is generally the minimum entrance requirement for young people seeking careers as physicists. Graduate training is required for many entry positions and is helpful for advancement in all areas of work.

A doctor's degree usually is required for full faculty status at colleges and universities. It is usually needed for employment in positions involving responsibility for research and development with any type of employer.

Physicists with master's degrees qualify for many research jobs in private industry, educational institutions, and government. Some also obtain positions as instructors in colleges and universities. Usually, graduate

students working toward a doctor's degree are assigned to teach elementary college courses, conduct laboratory sessions, or assist senior faculty members on research projects.

Physicists with bachelor's degrees qualify for a variety of jobs in applied research and development work in private industry or the Federal Government. Some become research assistants in colleges and universities while working toward advanced degrees. Many persons with a bachelor's degree in the science do not work as physicists but go into nontechnical work, other sciences, or engineering.

Training leading to the bachelor's degree in physics was offered by more than 700 colleges and universities in 1966. In addition, many engineering schools offered a physics major as part of the general curriculum. The undergraduate program in physics provides a broad background in the science, which serves as a base for later specialization either in graduate school or on the job. A few of the physics courses typically offered in an undergraduate program are mechanics, electricity and magnetism, optics, thermodynamics, and atomic and molecular physics. In addition, courses in chemistry and mathematics are required.

In 1966, the Ph. D. degree in physics was offered by approximately 150 colleges and universities. An additional 120 institutions offered graduate work in physics up to the master's degree level only. In graduate school, the student, with faculty guidance, usually works in a specific field. In 1965, the two fields of study engaging the most graduate students were solid-state physics, and nuclear and high energy physics. The graduate student spends a large portion of his time in research, especially the candidate for the Ph. D. degree.

### **Employment Outlook**

Employment opportunities for physicists will continue to be excellent through the remainder of the 1960's and in the 1970's. Opportunities will

stem primarily from the very rapid growth expected in this field. A small number of positions also will result from the need to replace physicists who transfer to other fields of work, retire, or die.

As in recent years, there probably will be a particular demand for physicists with advanced degrees to teach in colleges and universities. Among the factors contributing to the demand for physics teachers is the growing need for physics training in other sciences and engineering programs. Competition for well-qualified physicists has been, and probably will continue, creating difficulties in the recruitment of sufficient numbers of well-qualified university teachers. Physics teachers, who may be less highly trained, also will be needed in secondary education, as schools become increasingly more aware of the value of general knowledge of the physical world.

Physicists also will be required in substantial numbers to perform highly complex and demanding research and development work. Expenditures for research and development, which have increased rapidly in recent years, will probably continue to rise, although somewhat more slowly than in the past. Research organizations, whether those of government, universities, or industry, have considerable difficulty in satisfying their requirements for physicists with advanced degrees. Their future need for such physicists will probably continue at a very favorable level.

### **Earnings and Working Conditions**

Starting salaries for physicists with bachelor's degrees were usually between \$7,500 and \$8,000 a year in private industry in 1966, according to the limited information available. Physicists with master's degrees received starting salaries about \$1,000 to \$2,000 higher than those with bachelor's degrees. Depending on specialty and experience, graduates with Ph. D. degrees generally received entrance salaries around \$12,000 to

\$14,000 annually, although some were paid considerably less.

In the Federal Government in early 1967, physicists with the bachelor's degree and no experience could start at either \$6,387 or \$7,729 a year, depending on their college records. Beginning physicists who had completed all the requirements for the master's degree could start at \$7,729 or \$9,001. Physicists with the Ph. D. degree could begin at \$10,481 or \$11,306.

Starting salaries for physicists with the Ph. D. degree on college and university faculties ranged from \$7,000 to \$9,500 for the 1965-66 academic year. (For further information, see statement on College and University Teachers.) Many faculty physicists supplement their regular incomes and satisfy their professional interests through consulting work and special research projects.

The average (median) annual salary for physicists was \$12,500 in 1966, according to the National Science Foundation's Register of Scientific and Technical Personnel. Only 10 percent earned less than \$7,800 a year, and about 10 percent earned \$20,000 or more.

### Where To Go for More Information

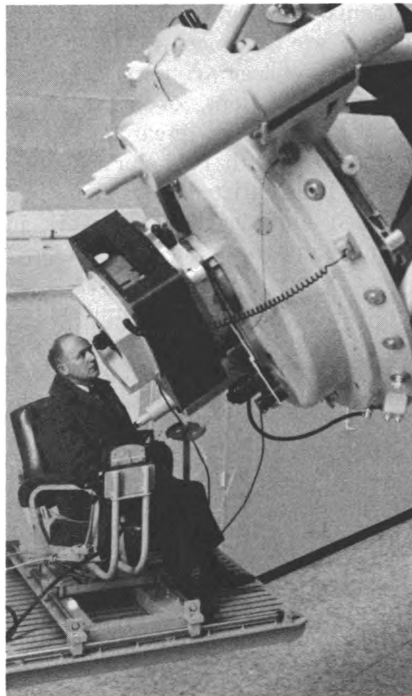
American Institute of Physics,  
335 East 45th St., New York, N.Y.  
10017.

## ASTRONOMERS

(D.O.T. 021.088)

### Nature of Work

Astronomy often is considered the most theoretical of all sciences, although it has many practical applications. Astronomers study all the celestial bodies in the universe. They collect and analyze data on the sun, moon, planets, and stars and attempt to determine sizes, shapes, surface temperatures, chemical composition, and motions of these bodies and of



the gases and dust between them. They compute the positions of the planets; calculate the orbits of comets, asteroids, and artificial satellites; and make statistical studies of stars and galaxies. Astronomers also study the size and shape of the earth and the properties of its upper atmosphere. Astronomical observations are valuable to navigation and the accurate measurement of time.

In making detailed observations of the heavens, astronomers use complex photographic techniques, light-measuring instruments, and other optical devices. The telescope is the major instrument used for observation. Devices for making specialized observations are usually attached to the telescope. Although most observations are made by means of telescopes permanently mounted in observatories, astronomers are gathering information increasingly by means of rockets and earth satellites containing various measuring devices. In processing and analyzing the vast amounts of data derived from their observations, astronomers often use electronic computers.

Astronomers usually specialize in one of the many branches of the sci-

ence. In *astrophysics*, they apply physical laws to stellar atmospheres and interiors. Some astronomers work in the field of *celestial mechanics*, one of the oldest fields of astronomy but one that has recently acquired new importance because it deals, in part, with the motions of objects in the solar system, and hence has a particular application in the calculation of the orbits of spacecraft and artificial earth satellites and the paths of ballistic missiles. *Radio astronomy* is the study, by means of radio telescopes of extraordinary sensitivity, of the source and nature of celestial radio waves. Among the other specialties are *astrometry* (measurement of angular positions and movements of celestial bodies); photoelectric and photographic *photometry* (measurement of the intensity of light); *spectroscopy of astronomical sources* (wave length analyses of radiation from celestial bodies); and *statistical astronomy* (statistical study of large numbers of celestial objects, such as stars, to determine their average properties).

Most astronomers are engaged in teaching, research, or a combination of the two functions. In colleges and universities not having separate departments of astronomy or having only small enrollments in the subject, astronomers may teach courses in mathematics or physics as well as astronomy. Other members of the profession are engaged in a variety of activities, including the development and design of astronomical instruments, administration, and consulting in areas to which astronomy is applied.

### Where Employed

Astronomy is one of the smallest of the science fields; in early 1967, the total number of astronomers in the United States was estimated to be about 1,100. Approximately two-fifths of all astronomers were employed by colleges and universities. Many of these worked in university-operated observatories, where they usually de-

voted most of their time to research, working alone or in cooperation with other astronomers. A number of other astronomers worked for observatories financed by nonprofit organizations.

The Federal Government employed several hundred astronomers in 1967. The major Government agencies employing astronomers were the National Aeronautics and Space Administration, the U.S. Naval Observatory, and the U.S. Naval Research Laboratory.

A growing number of astronomers were employed in private industry, mostly by firms in the aircraft, missile, and spacecraft field. A few astronomers worked for museums and planetariums.

### **Training, Other Qualifications, and Advancement**

Young people seeking professional careers in astronomy should obtain an advanced degree—preferably the Ph. D. The doctorate usually is required for high-level positions in teaching and research and is important for other types of work in this field. Although the bachelor's degree is adequate preparation for some entry jobs, astronomers without graduate work usually find that opportunities for promotion are limited.

Undergraduate curriculums leading to the bachelor's degree in astronomy are offered by relatively few schools. In 1966, only about 45 colleges and universities offered such a degree. The undergraduate work of the prospective astronomer is weighted heavily with courses in physics and mathematics. Courses in chemistry, statistics, and electronics are useful also. A few of the courses often taken by astronomy undergraduates are optics, spectroscopy, atomic physics, calculus, differential equations, solar and stellar systems, introductory astrophysics, and astronomical techniques and instruments.

The prospective astronomer is not necessarily handicapped if the college he has selected for his undergraduate study does not offer a major in astron-

omy. Well-qualified students with bachelor's degrees in physics or mathematics with a physics minor usually are able to enter and pursue graduate programs in astronomy without difficulty.

Programs leading to the doctorate in astronomy are available at about 35 institutions located in various sections of the country. The academic work of the graduate student consists primarily of advanced courses in astronomy, physics, and mathematics. A few of the astronomy courses typically offered in graduate schools are celestial mechanics, galactic structure, radio astronomy, stellar atmospheres and interiors, theoretical astrophysics, and binary and variable stars. Some schools require that graduate students spend several months in residence at an observatory. In most institutions, the program of work leading to the doctorate is flexible and allows the student to take the courses which will be of most value to him in his astronomical specialty or particular area of interest.

New graduates with bachelor's or master's degrees in astronomy usually begin as assistants in observatories, planetariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some persons, with only the bachelor's degree, work as research assistants while studying toward advanced degrees; others, particularly those in Government employment, receive on-the-job training in the application of astronomical principles. New graduates with the doctorate can usually qualify for college teaching positions and for research positions in educational institutions, Government, and industry.

### **Employment Outlook**

Employment opportunities for astronomers with the Ph. D. degree are expected to be excellent through the 1970's. Well-qualified persons with only bachelor's or master's degrees in astronomy also will have good employment prospects, primarily as re-

search and technical assistants. As in the past, however, the higher level professional positions in astronomy will be filled mainly by persons with the doctorate.

The outlook is for very rapid growth of this small profession, during the late 1960's and throughout the 1970's. However, because astronomy is a small profession, the number of job openings in any one year will not be large. On the other hand, because relatively few college students are expected to receive advanced degrees in astronomy each year, the young men and women who do obtain these degrees should have excellent employment opportunities.

Among the factors underlying the expected increase in demand for astronomers is the progress of the space age—the age of rockets, missiles, man-made earth satellites, and space exploration. Astronomers will be needed to analyze the data collected by rockets and spacecraft. They also will be needed to plan and give direction to the astronomical observations that can only be carried out by means of equipment placed in space vehicles.

Increased research activities in astronomy by educational institutions, Government, and industry are expected to add to the demand for astronomers. In recent years, the growth of Federal Government-sponsored research, in the form of grants to educational institutions and observatories (for astronomical research and for new buildings, observatories, and equipment), has opened many new positions for astronomers.

The most favorable opportunities for women astronomers will be in research positions in Government agencies and in the larger observatories. Educational institutions also are expected to offer some employment opportunities for women astronomers.

### **Earnings and Working Conditions**

In early 1967, beginning astronomers with the Ph. D. degree were eligible to enter Federal Government service at a salary of \$10,481 or

\$11,306 a year, depending on their college record. Astronomers with the bachelor's degree could start at \$6,387 or \$7,729 a year; those with a bachelor's degree and some graduate study could begin at \$7,729 or \$9,001.

Average starting salaries for an academic year for instructors of astronomy in colleges and universities ranged from about \$7,000 to \$9,500 in 1967, according to the limited data available. As the astronomer advances to higher level teaching positions, his earnings increase significantly. Some full professors earn over \$20,000 a year. Astronomers in

educational institutions often earn extra income by writing books and articles, lecturing, or consulting.

Some astronomers spend much time in nightwork, making visual photographic or photoelectric observations. Others make observations only 4 or 5 nights each month, or even only a few nights a year, and devote the remainder of the time to studying and analyzing photographic plates, photoelectric tracings, and other material during usual daytime working hours. Observational work at a telescope involves exposure to the outside air through the open dome of the

observatory, sometimes on cold winter nights. In general, however, the physical requirements of astronomical work can be met by a reasonably healthy person.

#### **Where To Go for More Information**

The American Astronomical Society,  
211 FitzRandolph Rd., Princeton,  
N.J. 08540.

Interagency Board of U.S. Civil Service  
Examiners for Washington,  
D.C.,  
1900 E. St. NW., Washington, D.C.  
20415.



## THE PERFORMING ARTS

The performing arts include music, acting, singing, and the dance. In these fields, the number of first-rate artists seeking employment is generally much larger than the number of full-time employment positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one of the facts young people should bear in mind in considering an artistic career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists must usually spend many years in intensive training and practice before they are ready for public performances. A person needs not only great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in his chosen field.

The statements which follow this introduction give detailed information on the musician, singer, actor, and dancer as performing artists and in related work.

### ACTORS AND ACTRESSES

(D.O.T. 150.028 and .048)

#### Nature of Work

Making a character come to life before an audience is a job which has great glamour and fascination. It is also hard and demanding work that

requires special talent and involves many difficulties and uncertainties.

Only a few of the approximately 15,000 actors and actresses in the United States in 1966, have achieved recognition as stars—on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who are frequently cast in supporting roles. The great majority, however, are struggling for a toehold in the profession, and are glad to pick up small parts whenever and wherever they can.

New actors generally start in "bit" parts, where they have only a few lines to speak. If successful, they may progress to larger supporting roles, of which there are several in most stage and screen productions. The actors who have minor parts in stage productions may also serve as understudies for the principals. If a leading player misses a performance, the understudy has a chance to demonstrate, and attract attention to, his acting ability.

Actors who prepare for roles either on the stage or in the movies spend many hours in rehearsal. They also must memorize their lines and know their cues. Radio actors typically read their parts. They have to be especially skilled in expressing character and emotion through the voice, since this is their sole means of creating an impersonation for their audience.

Besides the actors with speaking parts, "extras," who have no lines to deliver, are used in almost every motion picture and many television shows. In spectacular productions, a large number of extras take part in crowd scenes.

Some actors find jobs as dramatic coaches or become directors of stage, television, radio, or motion picture productions. A few teach in schools of acting or in the drama departments of colleges and universities.

#### Where Employed

Stage plays and motion pictures, including films made especially for

television, are probably the largest fields of employment for actors, although some are employed by "live" television and radio.

In the winter, most employment opportunities on the stage are in New York. In the summer months, stock companies in suburban and resort areas throughout the Nation provide many opportunities for employment. In addition, many cities now have community or "little" theaters, which provide opportunities for local talent as well as for professional actors and actresses from New York and other centers. Plays that go "on the road," moving from city to city, are normally produced in New York with casts selected there.

Although employment opportunities in motion pictures and film television are centered in Hollywood, a few studios are in Long Island, N.Y., Miami, Fla., and other parts of the country. In addition, many films are shot on location, providing employment for "extras" who live in the area. In live television and radio, most opportunities for actors are at the headquarters of the main networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television and radio stations occasionally employ actors.

#### Training and Other Qualifications

Since an actor learns mostly through practice, young people aspiring to acting careers should get as much acting experience as possible by taking part in high school and college plays, or working with little theaters and other acting groups in their home towns.

Formal training in acting may also be helpful. Such training can be obtained at special schools of the dramatic arts, located chiefly in New York. The dramatic arts are also taught in about 500 colleges and universities. A college degree is becoming increasingly necessary for an acting career. Because college drama curriculums usually include courses in liberal arts, speech, pantomime, play



production, and the history of the drama, as well as practical courses in acting, the actor develops an appreciation of the great plays, old and new, and a greater understanding of the roles he may be called on to play. Graduate degrees in the fine arts or in drama are necessary for college teaching positions.

Outstanding talent for acting and great interest and determination are essential for success in the theater. Ability to memorize, a good speaking voice, good health, and the physical stamina to work long hours are necessary. Ability to sing and dance is also an asset for those who seek an acting career.

In all media, whether the stage, motion pictures, radio, or television, the best way to start is to make use of local opportunities and to build on the basis of such experience. Many actors who are successful in local dramatic productions eventually try to appear on the New York stage. Inexperienced actors usually find it extremely difficult to obtain employment in New York or Hollywood.

The motion picture field is an espe-

cially difficult one to enter, and employment is often a result of previous experience on the Broadway stage.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency which works with the Screen Extras Guild and supplies all extras to the major movie studios in Hollywood. Applicants are accepted only when the number of people of a particular type on the list—for example, athletic young men, old ladies, or small children—is below the foreseeable need. In recent years, only a very small proportion of the total number of applicants have succeeded in being listed. Extras have very little, if any, opportunity to advance to speaking roles in the movies.

The length of an actor's working life depends largely on his skill and versatility. Great actors and actresses can go on almost indefinitely. On the other hand, for many members of the profession, employment opportunities become increasingly limited during and past middle age. This is especially true of those who become typed in romantic, youthful roles.

### Employment Outlook

The overcrowding which has existed in the acting field for many years is expected to persist. In the legitimate theater and also in motion pictures and radio and television, job applicants outnumber by many times the jobs available. Moreover, many actors are employed in their profession for only a small part of the year.

Because of the development of motion pictures, radio, and TV, employment opportunities for actors in the theater have been reduced greatly. The recent growth of summer stock companies has somewhat increased the employment of actors in the summer months.

Although a motion picture production may use a very large number of actors, they are employed only while the picture is being filmed; and the films are widely distributed and may be used for years. Radio uses few actors. The number of filmed TV dramas and commercials using actors is increasing, but not enough to offset the decline in the other media. More-

over, television stations often broadcast "taped" dramas rather than live productions, and, like motion picture films, these tapes may be widely distributed and used for a long time. Taped TV plays give employment to actors for only one performance, whereas live dramas may give employment for several performances.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in more cities. The number of communities with such acting groups is growing. Further increases are likely also in the employment of actors on television. In the acting field as a whole, however, employment opportunities are expected to change little through the 1970's. The number of new entrants to the profession is expected to outnumber employment opportunities that become available. Even highly talented young people are likely to face stiff competition and economic difficulties in the profession.

### Earnings and Working Conditions

Actors and actresses employed in the legitimate theater belong to the Actors' Equity Association. If employed in motion pictures, including television films, they belong to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc. If employed in television or radio, they belong to the American Federation of Television and Radio Artists. These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. In addition, each actor enters into a separate contract which may provide for higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in Broadway Productions was \$130 in mid-1967. Those appearing in small "off-Broadway" theaters had considerably lower earnings. For shows on the road, the minimum rate

was \$167.50 a week. For rehearsal time, it was \$130 a week in Broadway shows and much lower in small "off-Broadway" theaters. All minimum salaries are adjusted upward according to increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.

Motion picture actors and actresses had a minimum daily rate of about \$100 in early 1967. For extras, the minimum rate was about \$30 a day. Actors on network television received a minimum program fee of \$165 for a single half-hour program and 10 hours of rehearsal time; actors on radio received \$49.60 for a half-hour performance, including 1 rehearsal hour. To encourage more stable employment on radio and TV, minimum guarantees for those actors with contracts for a series of programs are sometimes discounted below the single program guaranteed fee.

In all fields, many well-known actors and actresses have salary rates above the minimums. The salaries of the few top stars are many times the figures cited. On the other hand, because of the frequent periods of unemployment characteristic of this profession, annual earnings may be low for many of the lesser known performers.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. The basic workweek after the opening of a show is 36 hours, including limited time for rehearsals. Prior to the opening, however, the workweek is usually longer to allow enough time for rehearsals. Evening work is, of course, a regular part of a stage actor's life. Rehearsals may be held late at night and over weekends and holidays. Traveling over the weekend is often necessary when plays are on the road.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which their employers contribute; but very few have paid vacations or sick leave. Most stage actors get little if any

unemployment compensation, since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, they often have to take any casual work obtainable while waiting for another role.

### DANCERS

(D.O.T. 151.028 and .048)

#### Nature of Work

Dancing is an ancient and worldwide art, having many different forms. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, or in tap and other popular kinds of dancing. In the classical ballet, movements are based on certain conventional or styled "positions," and women dance "en pointe" (on the tips of their toes). In the modern dance, movements are much more varied but are nonetheless carefully planned and executed to follow a pattern.

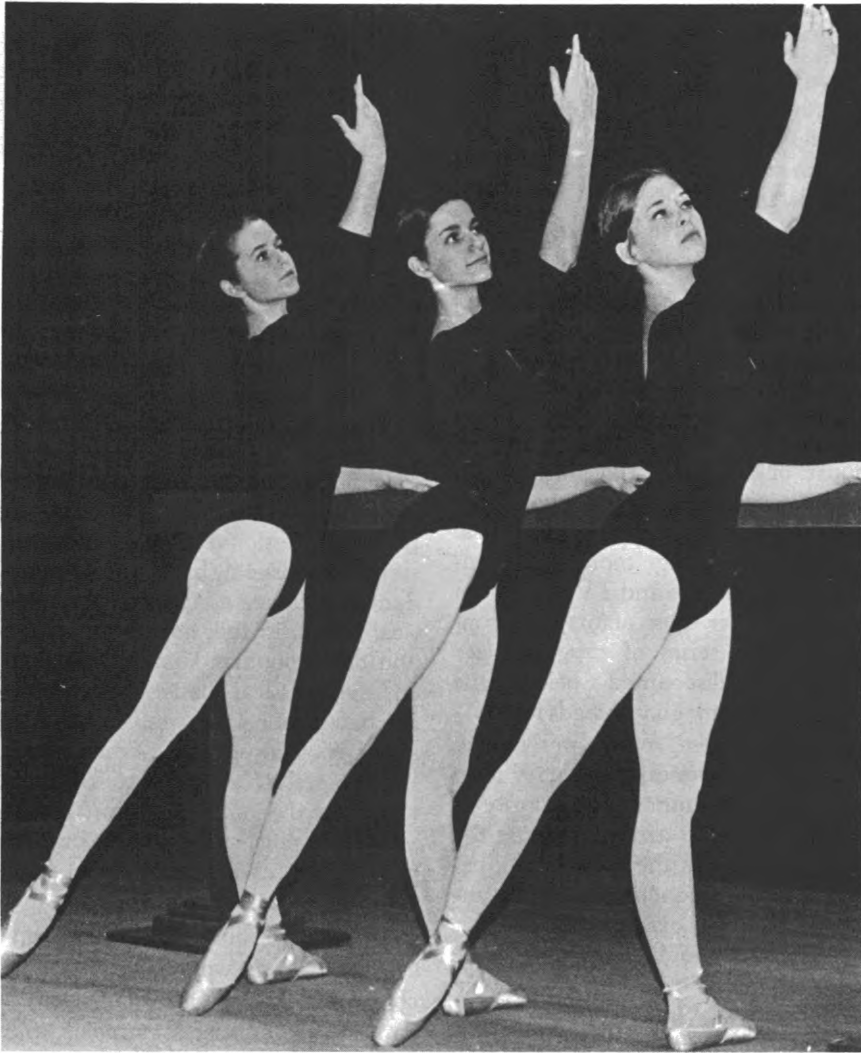
In dance productions, the performers most often work together as a chorus. However, a group of selected dancers may do special numbers, and a very few top artists do solo work.

Many dancers combine teaching with their stage work or teach full time in schools of the dance or in colleges and universities. The few dancers who have become choreographers create new ballets or dance routines. Others are dance directors who train dancers in new productions.

This statement does not include instructors of ballroom and other social dancing.

#### Where Employed

In 1967, there were approximately 24,000 dancers and dancing teachers in the United States. It is estimated that more than half of this number



were teachers employed at schools of the dance and in schools and colleges. Most of the other dancers were performers on the stage, screen, and television. A few teachers trained in dance therapy were employed by hospitals to work in the treatment of mental disorders. About 80 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women performers constitute about one-half.

Although dancing teachers are located chiefly in large cities, many smaller cities and towns have schools of the dance. New York City is the hub for the majority of performing dancers; others are situated in Los Angeles, San Francisco, and Chicago.

### Training and Other Qualifications

The traditional way of preparing for a dancing career is to begin serious training by age 12 or earlier. Girls wishing to become ballet dancers should begin taking lessons at the age of 7. In either case, 2 or 3 years of prior preparation is needed before the young girl should start dancing "en pointe." Professional training typically takes from 10 to 12 lessons a week for 11 or 12 months in the year and many additional hours of practice. The length of the training period depends on the student's ability and physical development, but most dancers have their professional audition by age 17 or 18.

The selection of a professional dancing school is important for two reasons. First, the school must use expert judgment in setting the pace of training, since too early and too severe exercise can permanently damage the legs and feet. Second, the school's connections with producers may help the students in obtaining employment.

Because of the strenuous training program in the professional schools, the general education received by students in these schools may not exceed the legal minimum. However, a dancer's education should include such subjects as music, literature, and history to aid him in his interpretation of dramatic episodes and music. Nearly 150 colleges and universities confer bachelor's degrees on students who have either majored in physical education and concentrated on the dance, majored in a dance program designed to prepare students to teach dance, or majored in a dance program designed to prepare students as professional dance artists. Some of these schools also give graduate degrees. Labanotation, which is the method of writing dance routines, is one of the advanced courses taught, and is especially important to choreographers.

A college education is an advantage in obtaining employment as a teacher of professional dancing or choreography. However, dancers who postpone their first audition for openings in classical ballet until graduation may compete at a disadvantage with younger dancers. On the other hand, they can compete successfully for openings in modern dance performances which do not require a proficiency in toe dancing.

A teaching position in professional schools usually requires experience as a performer; in colleges and conservatories, graduate degrees are generally required, but often experience as a performer may be substituted. Maturity and a broad educational background are also important for teaching positions.

Excellent health and unusual physical vitality are necessary for a dancing career. Height and body build should not vary much from the average. Good feet and normal arches are required. These physical qualifications must be accompanied by a natural aptitude for dancing.

For women dancers, employment in ballet companies is very difficult to obtain after the age of 30, except for outstanding stars. Women past 25 are rarely hired for Broadway shows unless they have already had experience in such productions. Men who are ballet dancers, and men and women who perform in modern dance productions, can usually continue somewhat longer. After the employable age as performers has passed, some dancers teach in colleges, or conservatories, or establish their own schools. The few who become choreographers or dance directors can continue working as long as people in most other occupations.

### Employment Outlook

Opportunities in this field will be limited both by the small number of full-time jobs available, and the large supply of experienced applicants seeking full-time work. The supply of trained dancers has exceeded the demand for many years. The irregular employment experienced in this profession for many years may persist despite a few recent union-management contracts aimed at guaranteeing some dancers full or near-full employment each year. Among the factors affecting demand are the decline in the total number of stage productions because of competition from motion pictures and television. Few stage shows run more than 26 weeks and many "fold" after the first week. On the other hand, the number of shows being produced is increasing, and there is a growing trend toward using professional dancers at industrial exhibitions, such as auto shows. Also, some new professional dance companies are being developed around the country, and television

will offer some additional employment opportunities. Civic and community dance groups are increasing in number, and opportunities for dancers will expand as these develop into professional groups. Nevertheless, employment opportunities for dance performers will remain limited, and most of the openings for dancers in the years ahead will stem from the need to replace those who leave the field.

The employment outlook for dancers who have the personal and educational qualifications for teaching will be much better than for those trained only as performers. The growing interest in the dance as one of the fine arts is contributing to the demand for teachers of dancing. The increase in college enrollments will be another factor which will tend to enlarge teaching opportunities. (See statement on College and University Teachers.)

Men dancers face less competition for employment than do women dancers, since fewer men than women seek dancing as a career.

### Earnings and Working Conditions

Dancers who perform professionally are members of one of the unions affiliated with the Associated Actors and Artists of America (AFL-CIO). The American Guild of Musical Artists, Inc., is the union to which dancers belong who perform in opera ballets, classical ballet, and the modern dance. Dancers who perform on television belong to the American Federation of Television and Radio Artists, and those who appear in musical comedies join Actors' Equity Association. Dancers may also belong to other unions, depending upon the field in which they perform. (See statement on Singers and Singing Teachers.) Minimum salary rates, hours of work, and other conditions of employment are specified in basic agreements signed by the unions and the producers. In addition, the separate contract signed by each dancer with the producer of the show has to

be at least as favorable as the basic agreement regarding salary, hours of work, and working conditions.

The minimum salary for dancers in ballet and other stage productions was \$145 a week, as of mid-1967. The minimum rate for rehearsal time was \$115 a week, except in small ballet companies which provide \$100. for a rehearsal week. When a show goes on tour, salaries are increased, since dancers pay their own hotel bills. The employer pays the cost of first-class transportation. If a dancer signs a contract for a brief appearance in a performance on television or a few days' work in a movie the minimum rate is higher, relative to time worked. However, this difference is offset by the brevity of the engagement and the long period likely to be spent waiting for the next one. A few performers, of course, have much higher salaries. For principals, choreographers, and stars, salaries in stage productions ranged from \$200 to over \$2,000 a week in 1967.

Some dancers qualified to teach in schools of the ballet are able to combine this work with engagements as performers. A much greater number of dancers have to supplement their incomes by other types of work.

Salaries of teachers in the technical schools of the ballet vary with the location and prestige of the school. Dancers employed as teachers in colleges and universities are paid on the same basis as other faculty members. (See statement on College and University Teachers.)

The normal workweek is 30 hours spent in rehearsals and matinee and evening performances. Extra compensation is paid for hours worked outside the normal workweek. Most stage performances are, of course, in the evening, and rehearsals may require very long hours, often on week-ends and holidays. When shows are on the road, traveling over the week-end is often required.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their

unions, to which the employers contribute.

### Where To Go for More Information

Information on colleges and universities and conservatories of music which give a major in the dance or some courses in the dance, and details on the types of courses and other pertinent information may be obtained from the Dance Directory, 1966 edition, compiled by the American Association for Health, Physical Education and Recreation, a division of the National Educational Association, 1201 16th St. NW., Washington, D.C. 20036.

Information on wages and working conditions may be obtained from:

American Guild of Musical Artists,  
1841 Broadway, New York, N.Y.  
10023.

### MUSICIANS AND MUSIC TEACHERS

(D.O.T. 152.048 and .028; 090.168;  
091.168; and 092.228)

#### Nature of Work

Professional musicians—whether they play in a symphony orchestra,

dance band, or “jazz combo”—have behind them many years of study and intensive practice. As a rule, musicians specialize in either popular or classical music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, or one of the “rhythm” instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, and solo performers sometimes give concerts and perform on television.

Musicians specializing in classical music play in opera and theater orchestras, symphony orchestras, and for other kinds of performances requiring orchestral accompaniments. The instruments played by most of these musicians are the strings, brass, and wood winds. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music.

Many pianists accompany vocal or instrumental soloists or choral groups or provide background music in restaurants or other places. Most organists play in churches, often directing the choir. A very few exceptionally brilliant and well known musicians become concert artists, giving their

own concerts and appearing as soloists with symphony orchestras. Both classical and popular musicians often make recordings, either individually or as members of a group.

A very high proportion of all musicians teach in the Nation's schools and colleges and are seldom, if ever, paid for performing. These teachers may be members of the faculty of music schools or conservatories or of colleges which offer instruction in instrumental music. Some are music teachers in elementary or secondary schools where they direct vocal and instrumental music programs, teach general classroom music appreciation, and give group instruction on an instrument. Private lessons are given by many teachers employed by school systems, and by performing musicians, either in their own studios or in pupils' homes.

A few musicians work in the field of music therapy in hospitals, and in music libraries.

### Where Employed

An estimated 162,000 musicians were employed in 1967. Most professional musicians who perform work in large cities, principally in New York, Chicago, and Los Angeles, where the Nation's entertainment activities are concentrated. Music teachers in elementary and secondary schools, as well as in colleges and universities, are employed all over the country. Moreover, just about every town and city has at least one private music teacher. Dance bands and civic orchestras are also located in many communities, although in the smaller towns, their members are usually only part-time musicians with other regular jobs.

In addition to the people primarily employed as musicians or music teachers, thousands of qualified instrumentalists have other full-time jobs and only occasionally work as musicians. Most of these part-time musicians belong to dance bands, which are hired to play at private parties or for special occasions.



Others, with a background in classical music, play occasionally in an orchestra, become conductors or composers, or do some part-time teaching.

### Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To achieve a career as a performer or as a music teacher, young people need intensive training—either through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. They need to acquire not only great technical skill but also a thorough knowledge of music, and they must learn how to interpret music. Before a young person can qualify for advanced study in a music conservatory or in a college or university school of music, it is frequently necessary to have an audition. Many of the teachers in these schools are accomplished artists who will train only promising young musicians.

Many conservatories of music and college and university schools of music offer 4-year programs leading to a bachelor's degree in music education. Students who complete these programs can qualify for the State certificate required for elementary and secondary school positions. Conservatories and collegiate music schools also frequently award the degree of bachelor of music to students who major in instrumental or vocal music. The 4-year program leading to either of these degrees provides not only training as a performer but also a broad background in musical history and theory, together with some liberal arts courses. Advanced degrees are usually required for college teaching positions, but exceptions may be made for especially well-qualified artists.

Musicians who play jazz and other popular music must have an understanding of and feeling for that style of music, but skill and training in

classical styles may expand their employment opportunities. As a rule, when young, they take lessons with private teachers and then seize all opportunities, beginning while they are still in high school, to play in amateur or professional performances. Some groups of young people form their own small dance bands. As they gain experience and become known, the players may have opportunities to audition for other local bands, and, still later, for the better known bands and orchestras.

### Employment Outlook

As a field of employment, music performance has been overcrowded for many years, and it is expected to remain so through the 1970's. Opportunities for concerts and recitals are not numerous enough to provide adequate employment for all the pianists, violinists, and other instrumentalists qualified as concert artists. Competition is usually keen for positions which afford some stability of employment—for example, jobs with major orchestras and teaching positions in conservatories and colleges and universities. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been and will probably continue to be more than sufficient to give instruction to all the young people seeking lessons. Although many opportunities for single and short-term engagements playing popular music in night clubs, theaters, and other places can be expected, the supply of qualified musicians seeking such jobs is likely to remain greater than the demand. On the other hand, a shortage of highly qualified church organists may persist in many communities during the next few years; first-class, experienced accompanists and well trained, outstanding players of stringed instruments are likely to remain relatively scarce; and public school systems will probably continue to need more fully qualified music teachers and supervisors.

Employment opportunities for performers are expected to increase slightly over the long run. Although the number of civic orchestras in smaller communities has been growing steadily, many of these orchestras provide only part-time employment for musicians who work chiefly as teachers or in other occupations. Moreover, the openings created by the establishment of these orchestras have been more than offset by the decline in opportunities in the theater, radio, motion pictures, and other places, which has resulted, in part, from the greatly increased use of recorded music.

The employment outlook in music education for people who are qualified as teachers as well as musicians is considerably better than for just performers. A great increase in the numbers of young people of high school and college age will take place through the 1970's. Moreover, the number of schools with music programs is growing steadily, and interest in music as an avocation is also rising, as evidenced by the increasing sales of musical instruments. Thus, over the long run, an increase can be expected in the employment of elementary and secondary school music teachers and also in the teaching staffs of college and university music schools and conservatories of music.

### Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends to a large extent on their professional reputations. Musicians who were members of 1 of the 26 major symphony orchestras in the United States in 1967 had an average annual salary of \$6,900, according to the American Symphony Orchestras League, Inc. The average season was 37 weeks in 1967 although the New York and Boston symphonies had 52- and 50-week seasons, respectively. Instrumentalists who were members of small ensembles reportedly received as much as \$200 a concert. Those who

played in dance bands were paid from \$60 to \$300 a week in 1967, according to the limited information available.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers. (See statements on Elementary and Secondary School Teachers.) However, they frequently supplement their earnings by giving private music lessons and taking church positions. Earnings from private teaching are very uncertain and vary according to the musician's reputation, the number of teachers in the locality, the number of students desiring lessons, and the economic status of the community.

Musicians who are performers customarily work at night and on weekends. They must also spend considerable time in regular daily practice and in rehearsing new scores.

Performers may have relatively long periods of unemployment between jobs and, thus, the overall level of their earnings is generally lower than that of many other occupations. Moreover, they do not usually work steadily for one employer. Consequently, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay.

Most musicians who play professionally belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

### Where To Go for More Information

Information about wages, hours of work, and working conditions for professional musicians is available from:

American Federation of Musicians  
(AFL-CIO),  
641 Lexington Ave., New York, N.Y.  
10022.

American Guild of Musical Artists,  
1841 Broadway, New York, N.Y.  
10023.

Information about employment opportunities for church musicians, as well as the requirements for certification of organists and choir masters, may be secured from:

American Guild of Organists,  
630 Fifth Ave., New York, N.Y.  
10020.

A list of accredited schools of music is available from:

National Association of Schools of Music,  
1501 New Hampshire Ave. NW.,  
Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference,  
The National Education Association  
of the United States,  
1201 16th St. NW., Washington,  
D.C. 20036.

### SINGERS AND SINGING TEACHERS

(D.O.T. 152.048 and .028; 090.168;  
091.168; and 092.228)

#### Nature of Work

Professional singing is an art which usually requires not only a fine voice, but also a highly developed technique and, generally, a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as soloists in oratorios and other types of performances. The majority of all professional singers of classical music are soloists in churches or synagogues. Some singers also become members of opera and musical comedy choruses or other professional choral groups. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, and in nightclubs and other entertainment places. The best known popular music singers make and sell many recordings.

Since most singers of both classical and popular music have only part-time or irregular employment as singers, they often have full-time jobs of other types and sing only in the evenings or on weekends. Some give private voice lessons. A sizable number of singers are employed in elementary and secondary schools, where they are qualified to teach general music courses and lead choruses. Others give voice training or direct choral groups in churches, music conservatories, or in colleges and universities with schools or departments of music.

#### Where Employed

In 1967, almost 59,000 people were employed as professional singers or singing teachers. Opportunities for singing engagements are mainly in New York City, Los Angeles, and Chicago—the Nation's chief entertainment centers. Nashville, Tenn., also is a major place of employment for singers in both "live" performances and recordings, and for those who specialize in folk and country music. Persons trained as singers who teach music in elementary and secondary schools, colleges, universities, and conservatories of music are employed throughout the country. Many singers are employed part-time chiefly as church singers and choir masters.

#### Training and Other Qualifications

Young people who want to perform professionally as singers should acquire a broad background in music, including its theory and history. The ability to dance is also helpful, since singers are sometimes required to dance as well as to sing. In addition, boys and girls interested in a singing career should start piano lessons at an early age. As a rule, voice training should not begin until after the individual has matured physically, although young boys who sing in church choirs receive some training before



their voices change. Moreover, because of the work and expense involved in voice training—which often continues for years after the singer's professional career has started—it is important that a prospective singer show great determination and audition before a competent voice teacher to decide whether professional training is warranted.

Young people can prepare for careers as singers of classical music by enrolling in a music conservatory, a school or department of music connected with a college or university, or by taking private voice lessons. These schools provide not only voice training, but other training necessary for understanding and interpreting music, including music-related training in foreign languages and sometimes dramatic training. After completing a 4-year course of study, a graduate may be awarded either the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Young singers who plan to teach music in public elementary or secondary schools need at least a bachelor's degree with a major in music education and must meet the State certification requirements for teachers. Such training is available in over 500 colleges and universities throughout the country. College teachers are usually required to have a master's degree and sometimes a doctor's degree, but exceptions may be made for especially well-qualified artists.

Although voice training is an asset for singers of popular music, many with untrained voices have had successful careers. The typical popular song does not demand that the voice be developed to cover as wide a range on the musical scale as does classical music, and the lack of voice projection may be overcome by using a microphone.

Young singers of popular songs may become known by participating in amateur and paid performances in their communities. These engagements may lead to employment with local dance bands and possibly later with better-known ones.



Popular music singers reach a wider audience through recordings.

In addition to musical ability, it often takes perseverance, an outstanding personality, an attractive appearance, good contacts, and luck to achieve a singing career. Furthermore, a singing career is sometimes relatively short, since it depends on a good voice and public acceptance of the artist, both of which may be affected by age.

### Employment Outlook

The employment situation for singers will probably remain highly competitive through the 1970's. Competition among popular singers will continue to be especially keen. A great number of short-term jobs are likely to occur in the entertainment field—the opera and concert stage, movies, theater, nightclubs, radio and television, dance bands, and other places—but not enough to provide steady employment for all qualified singers. The demand for church singers is expected to expand because of the continued growth in number of religious congregations, but most of these openings will probably be filled either by part-time singers who have steady employment in other fields or by volunteers.

Little growth in overall employment opportunities for singers is likely over the long run. The use of recorded music has practically replaced the "live" singer on radio; also, the number of television performances given by singers is limited, although it may increase in future years. However, there is a growing demand for singers to record popular music and commercials for both radio

and television advertising. The outlook for singers who can meet State certification requirements for positions as music teachers, or who can qualify for college teaching, will be considerably better than for performers. As school enrollments increase, the demand for music teachers in the Nation's elementary and secondary schools is expected to grow, and some increased employment of music teachers can be expected in colleges and universities. In addition, music teachers will be needed to replace those who will transfer to other fields of work, retire, or die.

### Earnings and Working Conditions

Some singers employed by dance bands and the motion picture industry earn as much as \$200 a week, and a few well-known concert soloists, opera stars, and top recording artists of popular music may command more than \$1,000 for a performance. However, the majority of professional singers experience difficulty in obtaining regular employment and have to supplement their singing incomes by doing other types of work.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers in their school system. Private music teachers charge fees which vary greatly, depending on the teacher's reputation, the economic status of the families in the community, and other factors.

Singers generally work at night and on weekends. School teachers have regular working hours, and private voice teachers can usually give lessons

at their own convenience. Work in the entertainment field is seasonal, and few performers have steady jobs.

Singers who perform professionally on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or television or who make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and night club field belong to the American Guild of Variety Artists; those who sing in musical comedy and operettas belong to the Actors' Equity Association; and those who sing in the movies belong to the Screen Actors Guild, Inc. All of these unions are branches of the Associated Actors and Artists of America (AFL-CIO).

### Where To Go for More Information

Information about accredited schools and departments of music may be obtained from:

National Association of Schools of Music,  
1501 New Hampshire Ave. NW.,  
Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference,  
The National Education Association  
of the United States,  
1201 16th St. NW., Washington,  
D.C. 20036.

Information concerning salary and working conditions is available from:

American Guild of Musical Artists,  
1841 Broadway, New York, N.Y.  
10023.

and mechanical men, who cut and paste together the basic parts of the advertisement or other artwork, using a ruling pen and other drafting tools. Some workers, called *general boardmen*, spend nearly all their time at the drawing board performing many of these specializations. Often supporting the general boardmen or other specialists are apprentices who engage primarily in mechanical, routine, and noncreative functions such as separating colors, ruling pen work, washing paintbrushes, cutting mats, running errands, and so forth.

In a small office, the art director may perform the layout and boardwork himself, with the aid of appren-

tices. In a large office he may be responsible mainly for developing ideas with the layout man; setting standards; dealing with clients; and purchasing needed photographs, illustrations, lettering, and other art work from freelancers or art services.

Much of the advertising artists' work is in creating the concept and artwork for a wide variety of promotional items or "collateral material" (including direct mail advertising, booklets, folders, brochures, catalogs, counter displays, etc.) used to supplement newspaper and magazine ads or television commercials. They also may prepare slides, film strips, and other visual aids.

## OTHER ART RELATED OCCUPATIONS

### COMMERCIAL ARTISTS

(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

#### Nature of Work

The artwork appearing in newspaper and magazine advertisements, on billboard posters, brochures, catalogs, and television commercials often is created by a team of commercial artists. The *art director* supervises a group of artists of varying levels of skill and diverse specializations. He may develop the art aspects of an advertising plan which he turns over to a layout man for further refinement. The *layout artist* works up the construction or arrangement of the elements of the advertisement, planning the selection and layout of illustrations, photographs, and typography and determining color and other elements of design. Then he prepares a "rough visual" or sketch. After consulting with the director, he may make changes in the visual and complete a more comprehensive layout for the customer's consideration.

Working with the layout man in turning out the finished product are a variety of specialists such as *renderers*, who make rough pastel or wash drawings; *letterers*, who execute appropriate lettering either freehand or with mechanical aids; *illustrators*, who make sketches and drawings in more finished form; and *paste-up*



Commercial artists also create the formats of magazines and other publications, designing or laying out the editorial pages and features and producing or purchasing the necessary illustrations or artwork. Some commercial artists specialize in fashion illustrations, greeting cards, book illustrations, or in technical drawings for industry.

### Where Employed

An estimated 50,000 commercial artists were employed in early 1967; about one-fourth were women. 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 to be found. Some, however, are employed in nearly every city.

Most commercial artists are employed as staff artists on a regular salaried basis by advertising agencies, commercial art studios, advertising departments of large companies, printing and publishing firms, textile companies, television and motion picture studios, department stores, sign shops, mail-order houses, greeting card companies, and a variety of other business organizations. Many work as freelance artists, selling their artwork to any available customers—chiefly to the same kinds of organizations that employ salaried artists. Some salaried commercial artists also do freelance work in their spare time. A number of commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools on a regular or part-time basis.

### Training, Other Qualifications, and Advancement

Artistic ability and good taste are the most important qualifications for success in the field of commercial art, but it is essential that these qualities be developed by specialized training in the techniques of commercial and

applied art. In addition, extensive education in the fine arts—painting, sculpture, or architecture—and in academic studies provides a good foundation for obtaining employment in commercial art and is essential for promotion to higher level jobs.

The most widely accepted training for commercial art is the instruction given in art schools or institutes that specialize in commercial and applied art. To enter art school, a high school education usually, but not always, is required. Some schools admit only those applicants who demonstrate talent by submitting acceptable work samples. The course of study, which may include some academic work, generally takes 2 or 3 years, and a certificate is awarded on graduation. A growing number of art schools, particularly those in or connected with universities, require 4 or more years of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.). In these schools, commercial art instruction is supplemented by liberal arts courses such as English and history. Limited training in commercial art also may be obtained through public vocational high schools, private home-study schools, and practical experience on the job, but supplemental training usually is needed for advancement.

The first year in art school may be devoted primarily to the study of fundamentals—perspective, design, color harmony, composition—and to the use of pencil, crayon, pen and ink, and other art media. Subsequent study, generally more specialized, includes drawing from life, advertising design, graphic design, lettering, typography, illustrations, and other courses in the student's particular field of interest.

Accomplished draftsmanship, 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 de-

tailed work requiring excellent coordination, whereas illustrators and designers need imagination, a distinctive art style, and, in most cases, the ability to draw well. Some experience with photography is useful to those interested in art direction or design. For commercial artists engaged in freelance work, the ability to sell both ideas and finished work to clients is very important. Also, a business sense and responsibility in meeting deadlines are assets. Art directors need a strong educational background not only in art and business practices, but also in the liberal arts. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the clients' products or services.

Beginning commercial artists usually need some on-the-job training before they can qualify for other than strictly routine work. Advancement is based largely on the individual's artistic talent, creative ability, and education. After considerable experience, many commercial artists leave salaried employment for freelance work.

Most commercial artists assemble their best artwork into a folder, or "portfolio," to use in displaying their work. A good portfolio is essential in obtaining initial employment and freelance assignments as well as in changing jobs.

### Employment Outlook

Employment and advancement opportunities for talented and well-trained commercial artists in most kinds of work are expected to be good through the 1970's. Young people with only average ability and little specialized training, however, will encounter competition for beginning jobs and will have limited opportunity for advancement.

The demand for commercial artists will continue to vary with the kind of specialization: For example, opportunities for illustrators, except those who are well established and have a unique style, are expected to continue to decline, largely because of

increasing use of photography in advertising and editorial features. Demand for paste-up and mechanical artists is expected to increase but jobs for designers, art directors, and layout men are few, much sought after, and open only to experienced, highly talented, and creative artists.

Among the factors underlying an expected slow increase in employment of commercial artists through the 1970's is the upward trend in business expenditures for all kinds of visual advertising. Demand for television graphics, packaging design, poster and window displays, and greeting cards will create some increase in the employment of commercial artists. In addition, the growing field of industrial design is expected to require the services of more artists who are qualified to perform three dimensional work with engineering concepts. (See statement on Industrial Designers.)

Women with exceptional artistic talent will continue to find employment in all aspects of commercial art work, but particularly in the textile industry and as fashion illustrators in department stores.

### Earnings and Working Conditions

In early 1967, beginning commercial artists with no training beyond vocational high school typically earned \$60 a week; graduates of 2-year professional schools generally received \$70 a week, and graduates of 4-year post-high school programs typically received \$75 to \$85 a week, according to the limited data available. Talented artists with strong educational backgrounds and a good portfolio, however, sometimes started at higher salaries. After a few years of experience, qualified artists may expect to earn \$100 to \$150 a week or more. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, many beyond \$15,000 a year.

The earnings of freelance artists have an especially wide range, since

they are affected by such factors as the amount of artwork sold, the price that the individual artist receives for his work, and the nature of the work he performs. In 1967, a freelancer received from \$25 for a single black and white fashion sketch to \$750 for a figure in full color with a background; from \$1,000 to \$2,000 for a color cover for a national magazine; or from \$75 to \$250 for a book jacket. Sometimes freelance artists are paid for their services by the hour; paste-up and mechanical artists may be paid \$4 to \$8 an hour or more.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours and under a considerable amount of pressure in order to meet deadlines. Freelance artists usually have irregular working hours.

## INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

### Nature of Work

Industrial designers combine technical knowledge of materials, machines, and methods of production with artistic talent to improve the appearance and functional design of machine-made products. Since the public has a wide choice of styles in products such as radios, television sets, automobiles, refrigerators, and furniture, a primary objective of the industrial designer is to design his employer's product to compete favorably with similar goods.

As a first step, the industrial designer spends time doing historical research on the product or related products. He studies competition in the market and the ways in which the product may be used. Then, he sketches a variety of possible designs, which are examined from many points of view. For example, the designer consults engineers, production supervisors, and the sales and market research staff for their opinions on the

practicability of producing a newly designed product, or changing the design of an old product, and the sales potential of the proposed designs. After the most suitable design is selected by company officials, a model may be made by the designer. The first model of a new design is often made of clay so that it can be altered easily to reflect modifications. The final or working model is usually made of the material to be used in the finished product. If the model is approved in this form, it is put into production.

Industrial designers also may be called upon to do related types of work. For example, they may design containers and packages, prepare small exhibits for display purposes, or design the entire layout for industrial fairs. Some also design the interior layout of special purpose commercial buildings, such as gasoline stations and supermarkets.

Industrial designers employed by a manufacturing company usually find their work limited to the one or few products made by their employer; many senior designers, however, are now given a free hand to engage in long-range planning for new or diversified products. Designers who work as consultants to more than one industrial firm, either as freelance designers or as members of consulting firms, may plan and design a great variety of products.



### Where Employed

Most of the estimated 10,000 industrial designers in early 1967 were employed by large manufacturing companies and by design consulting firms. Of the remainder, the greatest number did freelance work or combined salaried employment with it. Some also worked for architects, and a few were on the staffs of firms of interior designers.

Industrial designers employed by consulting firms are located mainly in large cities. For example, the New York and Chicago areas have the largest number of design consulting organizations. Those employed by industrial firms are found most often in the manufacturing plants of their companies.

### Training, Other Qualifications, and Advancement

The completion of a course of study in industrial design—in an art school, an art department of a university, or a technical college—is the usual requirement for entering this field of work. People from other areas, however, notably engineering and architecture, may qualify as industrial designers if they have appropriate experience and artistic talent.

Formal education in industrial design at the college or university level usually takes at least 4 years to complete, and a few schools require 5 years of study. These schools award the bachelor's degree in industrial design or fine arts; about half of these schools also award the master's degree for advanced study in the field. Some schools, usually private art schools or those associated with large art museums, offer a 3-year course of study in industrial design which leads to a diploma. In the past few years, however, some art and museum schools have moved toward accreditation or affiliation with a university. If accredited or affiliated, they usually offer a 4-year program and the bachelor's degree.

Entrance to the course of study in industrial design is limited, with rare exceptions, to qualified high school graduates; in addition, some schools may require students to present sketches and other examples of their artistic ability. Some schools also require students to complete their freshman or sophomore years before they select an industrial design major.

Industrial design curriculums differ considerably among schools. Some schools stress the engineering and technical aspects of the field, and others give students a strong cultural background in art. Nevertheless, most industrial design curriculums include at least one course in two-dimensional design (color theory, spatial organization, etc.) and one in general three-dimensional design (abstract sculpture and art structures), including a substantial amount of studio practice in the actual design of three-dimensional products. In the studio course, students learn to make working drawings and models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students gain experience in making models of their designs while learning to use metalworking and woodworking machinery. Some schools require the completion of courses in basic engineering and in the composition of materials. All schools which offer 4- or 5-year courses leading to a bachelor's degree also include academic subjects, such as English, history, psychology, economics, and science, in their curriculums.

Creative ability, skill in drawing, and the ability to anticipate consumer needs are the most important personal qualifications needed by young people aspiring to work in this field. A mechanical interest is also desirable for some types of work. Applicants for jobs will find it helpful to have previously assembled a "portfolio" which demonstrates their skill in designing and their creative talent. Since industrial designers are frequently required to work cooperatively with engineers and other staff

members, ability to work and communicate well with others is important. Young people who plan to practice industrial designing on a consulting basis should have a knowledge of business practices, and possess sales ability.

New graduates of industrial design courses frequently start as assistants to other designers. They are usually given relatively simple assignments which do not involve making structural changes in the product. As they gain experience, designers may be assigned to supervisory positions with major responsibility for the design of a product or a group of products. Those who have an established reputation in the field, as well as the necessary funds, may open their own consulting firms.

### Employment Outlook

Employment in this relatively small occupation is expected to expand moderately through the 1970's. Employers will be actively seeking applicants with a college degree and outstanding talent. Some employment opportunities will also arise each year from the need to replace designers who retire or leave the field for other reasons. Although these vacated positions are likely to be filled by promoting designers' assistants, such promotions result in openings at the entry level.

A number of factors will affect employment of industrial designers. Rapid obsolescence of household and commercial equipment and the rising population will increase the demand for newly designed products. As in the past, manufacturers will strive to hold or increase their share of these markets through the creation of new products, improvements in the design of existing ones, and change in package designs and other modernizations in the appearance and use of their products. Small companies probably will make increasing use of services offered by industrial design consulting firms in order to compete more effectively with larger firms. All

of these factors, in addition to rising per capita income, will contribute to long-term growth in the employment of industrial designers. However, as in the past, new entrants trained specifically in industrial designing are likely to encounter keen competition for beginning jobs from persons with engineering, architectural, and related educational backgrounds who have artistic and creative talent as well. Also, since personnel needs in this profession are very closely related to general business conditions, any downturn in the economy would tend to affect adversely the employment outlook.

### Earnings

Starting salaries of inexperienced industrial designers employed by manufacturing firms ranged from \$125 to \$150 a week in 1966, according to the limited information available. Beginning salaries of those employed by consulting firms were usually lower. Salaries of experienced industrial designers vary greatly, depending on individual ability, size and type of firm in which employed, and other factors. According to scattered reports, those with several years of experience earned salaries ranging from \$8,000 to \$14,000 annually. Some large manufacturing firms paid \$25,000 or more to experienced and talented designers.

Earnings of industrial designers who own their consulting firms, alone or as members of a partnership, may fluctuate markedly from year to year. In recent years, earnings of most consultants ranged between \$12,000 and \$20,000, a few outstanding industrial designers earned as much as \$200,000.

### Where To Go for More Information

Industrial Designers Society of America,  
60 West 55th St., New York, N.Y.  
10019.

National Association of Schools of Art,  
50 Astor Pl., New York, N.Y. 10003.

## INTERIOR DESIGNERS AND DECORATORS

(D.O.T. 142.051)

### Nature of Work

The creative work of interior designers and decorators enhances the attractiveness of our homes and other buildings. Designers and decorators plan the functional arrangement of interior space and coordinate the selection (including colors) of furniture, draperies and other fabrics, floor coverings, and interior acces-

sories. They may work on the interiors of residential or commercial structures, as well as ships and aircraft. Some design stage sets used for motion pictures and television. Interior designers are more concerned than decorators with space planning and other interior design; they often work for clients on large design projects such as the interior of an entire office building. Generally, their plans include the complete layout of the rooms within the space allowed by the exterior walls and other framework. Sometimes they redesign the interiors of old structures. When their plans have been completed, the architect checks them against his blueprints to assure compliance with building requirements and to solve structural problems. Some interior



Interior designer discusses fabric selection with client.

designers also design the furniture and accessories to be use in interiors and then arrange for their manufacture.

Many professionals in this field have their own establishments, either alone or as a member of a firm with other designers and decorators; they may sell some or all of the merchandise with which they work. Some work independently, or with one assistant; others have large staffs, sometimes including salespeople.

Many of the larger department and furniture stores have separate departments of interior decorating or interior design, or both, to advise customers on decorating and design plans. The main function of these departments is to help sell the store's merchandise, although materials from outside sources may be used when they are essential to the plans developed for the customer. Department store decorators and designers frequently advise the stores' buyers and executives concerning style and color trends in interior furnishings.

Interior designers and decorators usually work directly with clients to determine preferences and needs in furnishings. They may do "board-work," particularly on large assignments, which includes work on floor plans and elevations and creation of sketches, or other perspective drawings in such media as watercolor, pastels, or tempera, so clients can visualize their plans. They also provide cost estimates. After the client approves both the plans and cost estimates, arrangements are made for the purchase of the furnishings; for the supervision of the work of painters, floor finishers, cabinetmakers, carpetlayers, and other craftsmen; and for the installation and arrangement of furnishings.

### Where Employed

More than 15,000 people were engaged full time in interior design and decoration in early 1967. About half of them were women. Men, however, predominate in interior de-

sign. Many in design and decorating work on a part-time basis.

The majority of all workers in this field are located in large cities. In recent years, large department and furniture stores have become increasingly important sources of employment for professional interior designers and decorators. Some designers and decorators have permanent jobs with hotel and restaurant chains. Others are employed by architects, antique dealers, office furniture stores, industrial designers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field, or by periodicals that feature articles on homefurnishings. Some large industrial corporations employ interior designers on a permanent basis.

### Training, Other Qualifications, and Advancement

Formal training in interior design and decoration is becoming increasingly important for entrance into this field of work, although many present members of the profession achieved success without such training. Most department stores, well-established design and decorating firms and other major employers will accept only professionally trained people for beginning jobs. Usually, the minimum educational requirement is completion of either a 2- or 3-year course at a recognized art school or institute specializing in interior decorating and design, or a 4-year college course leading to a bachelor's degree with a major in interior design and decoration. The course of study in interior design and decoration usually includes the principles of design, history of art, freehand and mechanical drawing, painting, the study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods, metals, plastics, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in salesmanship, business arithmetic,

and other business subjects are of great value.

Membership in either the American Institute of Interior Designers (AID) or the National Society of Interior Designers (NSID), both professional societies, is a recognized mark of achievement in this profession. Such membership usually requires the completion of 4 years or more of post-high school education, the major emphasis having been on training in design, and several years of practical experience in the field, including responsibility for supervision of all aspects of decorating contracts.

New graduates with training in interior design and decorating usually serve a training period, either with decorating firms, in department stores, or in the firm of an established designer. They may act as a receptionist, as a shopper with the task of matching materials or finding accessories, or as a stockroom assistant, assistant decorator, or junior designer. In most instances, from 1 to 3 years of on-the-job training is required before a trainee is considered eligible for advancement to the job of decorator. Beginners who do not obtain trainee jobs often work as salespeople for fabric, lamp, or other interior furnishings concerns, to gain experience both in dealing with customers and to become familiar with the merchandise. This experience often makes it easier to obtain trainee jobs with a decorating firm or department; it may also lead to a career in merchandising.

After considerable experience, decorators and designers with ability may advance to head of decorating or design departments, interior furnishings coordinator, or to other supervisory positions in department stores, or in large decorating or design firms; if they have the necessary funds, they may open their own establishments. Talented workers usually advance rapidly.

Artistic talent, imagination, good business judgment, and the ability to deal with people are important assets for success in this field.



### Employment Outlook

Talented art school or college graduates who majored in interior design and decoration will find good opportunities for employment through the 1970's. Applicants who can design and plan the functional arrangement of interior space will be in strong demand. Young people without formal training will find it increasingly difficult to enter the field.

A slow but steady increase in employment of interior designers and decorators is anticipated through the 1970's. Population growth, larger expenditures for home and office furnishings, the increasing availability of well-designed furnishings at moderate prices, a growing recognition among middle-income families of the value of decorators' services, and increasing use of design services for commercial establishments should contribute to a greater demand for these workers. In addition to newly created jobs, some openings will arise each year from the need to replace designers and decorators who die, retire, or leave the field for other reasons.

Department and furniture stores are expected to employ an increasing number of trained decorators and designers. These stores are also expected to share in the growing volume of design and decorating work for com-

mercial establishments and public buildings, formerly handled almost entirely by independent decorators. This development will result in increased opportunities in salaried employment. Interior design firms are also expected to continue to expand. However, employment of interior decorators and designers is sensitive to changes in general economic conditions because people often defer these kinds of expenditures when the economy slows down.

### Earnings and Working Conditions

Beginning salaries ranged generally from \$70 to \$90 a week in early 1967 for art school or college graduates with formal training in interior design and decoration; some graduates of 4-year design schools received salaries of \$100 or more a week, according to limited data available.

Many interior decorators with only average skill in this field earn only moderate incomes—from \$5,000 to \$7,500 a year, even after some years of experience. Talented decorators who are well known in their localities may earn up to \$12,000 or more. Designers and decorators whose abilities are nationally recognized may earn well beyond \$25,000 yearly.

Decorators in business for them-

selves have an especially wide range of earnings; their profits are related to factors such as the volume of business, their prestige as a decorator, economic level of their clients, their own business competence, and the percentage of wholesale prices they receive from sale of furnishings. Decorators and designers in the employment of others also have variable earnings. Some are paid straight salaries; some receive salaries plus commissions which usually range from 5 to 10 percent of the value of their sales; others receive commissions only, which may be as much as one-third of the value of their sales.

Hours of work for decorators are sometimes long and irregular. They usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends, when necessary. Designers' schedules follow a more regular workday pattern.

### Where To Go for More Information

Information about employment and scholarship opportunities may be obtained from:

National Society of Interior Designers, Inc.  
Suite 700, 157 West 57th St., New York, N.Y. 10019.

## SOCIAL SCIENCES

The social sciences are concerned with all aspects of human society from the origins of man to the latest election returns. Social scientists, however, generally specialize in one major field of human relationships. Anthropologists study primitive tribes, reconstruct civilizations of the past, and analyze the cultures and languages of all peoples past and present. Economists study how man allocates resources of land, labor, and capital. Geographers study the distribution throughout the world of people, types of land and water masses, and natural resources. Historians describe and interpret the people and events of the past and present. Political scientists study the theories, objectives, and organizations of all types of government. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society.

Besides these basic social science fields, there are a number of closely related fields, some of which are covered in separate statements elsewhere in this *Handbook*. (See statements on Statisticians, Psychologists, and Social Workers.)

About 50,000 people were employed professionally in the basic social sciences in 1966. About 1 of every 10 was a woman. Overlapping among the basic social science fields and the sometimes hazy distinction between these and such related fields as business administration, foreign

service work, and high school teaching, make it difficult to determine the exact size of each profession. Economists, however, are the largest social science group, and anthropologists the smallest.

The majority of social scientists are employed by colleges and universities. The Federal Government is the second largest employer. Except for economists, private industry employs comparatively few persons in social science professions; however, there is a trend in some industries toward hiring increasing numbers of college graduates who have majored in the social sciences as trainees for administrative and executive positions. Research councils and other nonprofit organizations provide an important source of employment for economists, political scientists, and sociologists.

Employment in the social sciences has been increasing and is expected to grow rapidly through the 1970's, mainly because of the anticipated rise in college teaching positions. The reasons for this expected increase are discussed in the statement on College and University Teachers. A moderate rise in employment in government also is expected. Employment in government agencies is often greatly affected by changes in public policy. For example, more social scientists will be needed to handle research and administrative functions resulting from the new programs established by Congress to relieve unemployment and remove poverty. The Vocational Education Act of 1963, the Economic Opportunity Act of 1964, and the Appalachian Regional Development Act of 1965 are recent programs that will increase the demand for social science personnel. A moderate rise in employment in private industry and nonprofit organizations also is expected. In addition, hundreds of social scientists will be needed each year to replace those who leave the field because of retirement, death, or other reasons.

Social scientists with doctor's degrees will find excellent employment opportunities through the 1970's, in both teaching and nonteaching posi-

tions. For those with less training, the employment situation will differ considerably among the several social science fields. These differences are discussed in the occupational statements that follow.

## ANTHROPOLOGISTS

(D.O.T. 055.088)

### Nature of Work

Anthropologists study primitive and civilized man—his origins, physical characteristics, customs, languages, traditions, material possessions, and social and religious beliefs and practices. Most anthropologists specialize in cultural anthropology—usually archeology or ethnology. *Archeologists* excavate the places where earlier civilizations are buried in order to reconstruct the history and customs of the people who once lived there, by studying the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity. For example, archeologists are digging in the Pacific Coast area between northern Mexico and Ecuador to find evidences of trade and migration in the pre-Christian Era. Some archeologists are excavating ancient Mayan cities in Mexico and restoring temples. Others are working in the Missouri river valley to salvage remnants of Indian villages and sites of early military forts and trading posts. *Ethnologists* may spend long periods living among primitive tribes or in other communities, to learn about their ways of life. The ethnologist takes detailed and comprehensive notes describing the social customs, beliefs, and material possessions of the people, usually learning their language in the process. He also may make comparative studies of the cultures and societies of various groups. Some cultural anthropologists specialize in *linguistics*, the scientific study of the sounds and structures of languages and of the historical relationships among languages.

A few hundred people 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 and groups of mankind. Because of their knowledge of body structure, physical anthropologists are occasionally employed as consultants on such projects as the design of more comfortable space suits and cockpits for astronauts.

Most anthropologists teach in colleges and universities and often combine research with their teaching. Some anthropologists specialize in museum work, which generally combines management and administrative duties with fieldwork and research on anthropological collections. A few are engaged primarily in consulting, nontechnical writing, or other activities.



Philippine Hanunóo tribesman shows anthropologist how folklore is inscribed in bamboo.

### Where Employed

About 2,700 people were employed as anthropologists in 1967. About a fifth of them were women. The great majority were employed in colleges and universities. The Federal Government employed a considerable number, chiefly in museums, national parks, and in technical aid programs. The Government agencies which employed the largest number of anthropologists were the Smithsonian Institution and the National Park Service. Many other Government agencies, including the Departments of Defense and of Health, Education, and Welfare, employed some members of the profession, mainly as consultants. State and local government agencies also employed some anthropologists, usually for museum work or health research. A few were employed in private industry and nonprofit organizations.

### Training, Other Qualifications, and Advancement

Young people who are interested in careers in anthropology should ob-

tain Ph. D. degrees. College graduates with bachelor's degrees can obtain temporary positions and assistantships in the graduate departments where they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions is generally reserved for individuals holding the Ph. D. degree. In many colleges, and most universities, only anthropologists holding the Ph. D. degree can obtain permanent teaching appointments.

Some training in physical anthropology, archeology, and ethnology is necessary for all anthropologists. Courses in linguistics also are valuable and are required for certain areas of work. A knowledge of mathematics is increasingly important since statistical methods and high speed computer technology are becoming more widely used for research in this field. Undergraduate students may begin their field training in archeology by arranging, through their university department, to accompany expeditions as laborers. They may 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. Ethnologists and linguists usually do their fieldwork alone, without direct supervision. Most anthropologists base their doctoral dissertations on data collected through 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. Students interested in museum work should select a school that 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 fieldwork or should plan to attend an archeological field school elsewhere during their summer vacations.

### Employment Outlook

The number of anthropologists is expected to increase very rapidly

throughout the 1970's. The largest increase in employment will be in the college teaching field. Some additional positions will be found in museums, archeological research programs, mental and public health programs, and in community survey work. Opportunities in other fields are likely to be limited largely to the replacement of personnel who retire, die, or leave their positions for other reasons.

Anthropologists holding the doctorate are expected to have excellent employment opportunities throughout the 1970's. Employment opportunities also should be favorable for those who have fulfilled all requirements for the Ph. D. degree except the dissertation. Graduates with only the master's degree, however, are likely to face persistent competition for professional positions in anthropology and may enter related fields of work. A few who meet certification requirements may secure high school 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.

### Earnings

Average (median) salaries of anthropologists employed by colleges and universities were \$12,500 for the calendar year in 1966; assistant professors, \$9,300; associate professors, \$13,200; and professors, \$16,000 according to the National Science Foundation's National Register of Scientific and Technical Personnel.

In the Federal Government, the starting salary for anthropologists completing all the requirements for the Ph. D. degree was \$9,221 in early 1967.

In general, anthropologists holding the Ph. D. degree earn substantially higher salaries than those with the master's degree. Many anthropologists supplement their regular salaries with earnings from other sources. Summer teaching and research grants

are the principal sources of income. Anthropologists employed in colleges and universities are the most likely to have additional earnings.

### Where To Go for More Information

Additional information concerning employment opportunities and schools offering graduate training in anthropology may be obtained from the following sources:

*Anthropology As A Career*, Smithsonian Institution,  
Washington, D.C. 20560.

The American Anthropological Association,  
3700 Massachusetts Ave. NW., Wash-  
ington, D.C. 20016.

## ECONOMISTS

(D.O.T. 050.088)

### Nature of Work

Economists study man's activities devoted to satisfying human wants. They are concerned with the problems which arise in utilizing limited resources of land, raw materials, manpower, and manufactured products so as to meet, as well as possible, people's many unsatisfied wants. In this connection, they may analyze the relation between the supply of and demand for goods and services, and the ways in which goods are exchanged, produced, distributed, and consumed. Some economists are concerned with such practical problems as the control of inflation, the prevention of depression, and the development of farm, wage, tax, and tariff policies. Others develop theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Still others are engaged in the collection and interpretation of data on a wide variety of economic problems.

Economists are employed as teachers in colleges and universities, and

as researchers in government agencies, private industry, and nonprofit research organizations. As teachers, they guide students in learning the principles and methods of economics, and frequently engage in writing, lecturing, or consulting activities. They also do research in economic theory and formulate many of the new ideas that directly or indirectly influence government and industry planning.

Most economists in the Federal Government are in the fields of agriculture, business, or labor economics, or in international trade and development. They may plan and carry out studies involving the collection of basic data in these fields, use these and other data to analyze the need for changes in government policy, assess the economic condition of the Nation, write reports on their findings, and present these reports before policy-making bodies.

Economists employed by business firms provide management with information to be used in making decisions on such matters as the markets for and prices of company products, recommendations regarding government policies affecting business or international trade, the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business.

### Where Employed

Economics is the largest of the basic social science fields. About 20,000 people were employed as economists in 1967. Roughly one-third were employed by colleges and universities and another third worked for government agencies—chiefly Federal. Most of the remainder were employed by private industry or worked for private research agencies and community organizations. A few were self-employed, acting as consultants.

Economists are found in all large cities and in university towns. The largest group is in the Washington, D.C., area, where most of those in the

Federal Government are located. A substantial number of economists are employed in foreign countries, mainly by the U.S. Department of State, including the Agency for International Development.

Most economists in private industry are employed in the home office of large corporations, particularly in New York City and Chicago.

### Training and Other Qualifications

All economists must have a thorough grounding in economic theory, economic history, and methods of economic analysis. An increasing number of universities also emphasize the value of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures is usually required.

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 entry jobs are not always regarded as professional economists. In the Federal Government, candidates for entrance positions must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

Graduate training is very important for young people planning to become economists. Students interested in research should select schools that emphasize training in research methods and statistics and provide good research facilities. Those who wish to work in agricultural economics will find good opportunities to gain experience in part-time research work at State universities having agricultural experiment stations.

The master's degree is generally required for appointment as a college instructor, although in large schools graduate assistantships often are awarded to superior students working toward their master's degree. In many large colleges and universities,

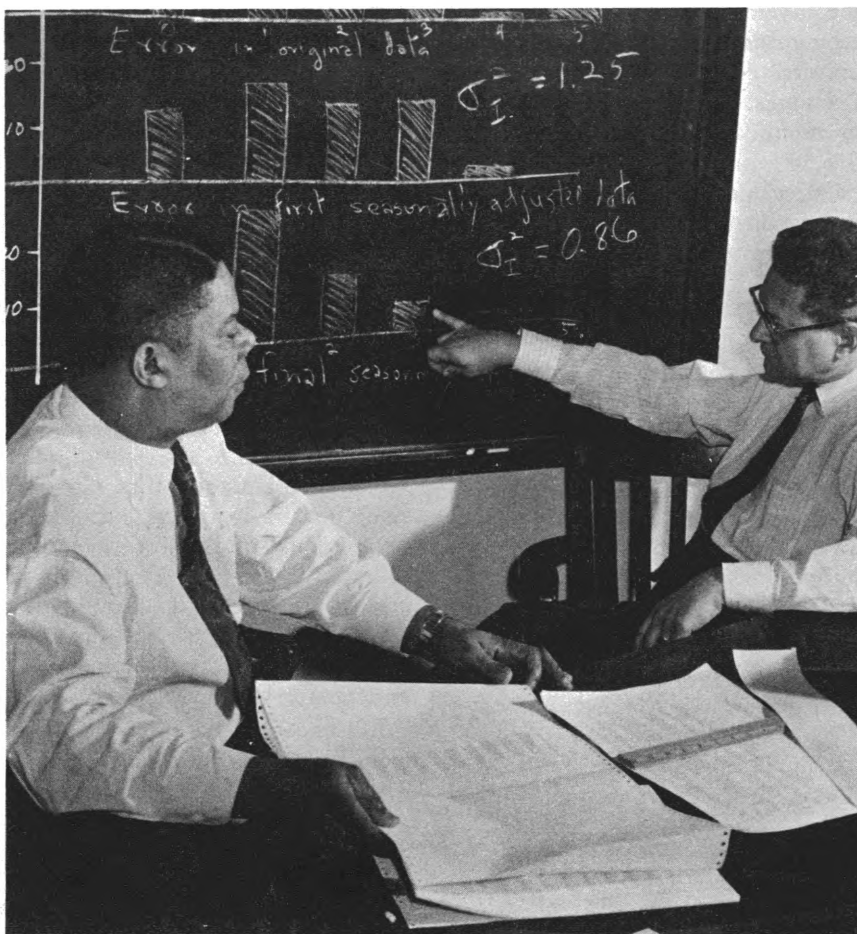
completion of all the requirements for the Ph. D. degree, except the dissertation, is necessary for appointment as instructor. In government or private industry, economists holding the master's degree can usually qualify for more responsible research positions than are open to those having only the bachelor's degree.

The Ph. D. degree is required for a professorship in a high-ranking college or university and is an asset in competing for other responsible positions in government, business, or private research organizations.

Economists interested in overseas assignments will find training in other social sciences, as well as advanced training in economics, very helpful. For some positions with the U.S. Department of State, considerable experience is also required.

### Employment Outlook

Employment of economists will increase very rapidly through the 1970's. Colleges and universities will need hundreds of new instructors annually to handle rapidly increasing enrollments and to replace economists who retire, die, or transfer to other fields of work. Private industry is expected to employ many more 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 at the Federal, State, and local levels also will increase rapidly in order to meet the need for more extensive data collection and analysis, and to provide the staff for programs aimed at reducing unemployment and poverty.



Economists analyze statistical data.

Economists with the doctorate are expected to have excellent opportunities for employment. The demand for these economists is expected to be considerably greater than the supply through the 1970's. As a result, employment opportunities for economists with a master's degree will be favorable, especially for those with good training in statistics and mathematics. Opportunities for persons holding a bachelor's degree will continue to be good in government agencies. Young people having bachelors' degrees in economics will also find employment as management trainees in industry and business firms.

### Earnings

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) salary of economists employed by colleges and universities was \$11,750 in 1966. Economists employed by business and by nonprofit organizations averaged \$15,300 and \$16,200, respectively. Salaries of economists engaged in the management or administration of research programs averaged \$17,500 annually.

In the Federal Government, the entrance salary for beginning economists with a bachelor's degree was \$5,331; however, those with superior academic records could begin at \$6,451 in early 1967. Those with 2 full years of graduate training or experience can qualify for positions at an annual salary of \$7,696. The majority of experienced economists in the Federal Government earned from \$9,200 to \$17,000 a year; some having greater administrative responsibilities earned considerably more.

### Where To Go for More Information

American Economic Association,  
Northwestern University, 629 Noyes  
St., Evanston, Ill. 60201.

Additional information on employment opportunities in economics and

related fields is given in the following publications:

*Careers in the Foreign Service*, U.S. Department of State, Publication 7924, Washington, D.C. 20520. Free.

*Overseas Assignments*, Agency for International Development, Washington, D.C. 20523. Free.

## GEOGRAPHERS

(D.O.T. 059.088)

### Nature of Work

Geographers study the physical characteristics of the earth, such as its terrain, minerals, soils, water, vegetation, and climate. They relate these characteristics to the patterns of human settlements on the earth—where people live, why they are located there, and how they earn a living.

The majority of geographers are engaged in college and university teaching and may combine teaching and research. Their research may include the study and analysis of the distribution of land forms, climate, soils, vegetation, and mineral and water resources, sometimes utilizing surveying and meteorological instruments. They also analyze the distribution and structure of political organizations, transportation systems, and marketing systems. Many geographers spend considerable time in field study, and in analyzing maps, aerial photographs, and observational data collected in the field. There is an increasing use of photographs and other data from remote sensors in satellites. Other geographers construct maps, graphs, and diagrams.

Most geographers specialize in one main branch of geography or more. Those working in *economic geography* deal with the geographic distribution of economic activities—including manufacturing, mining, farming, trade, and communications. *Political geography* is the study of the way political processes affect geo-

graphic boundaries on subnational, national, and international scales and the relationship of geographic conditions to political situations. *Urban geography*, a growing field for geographers, is concerned with the study of cities, and with community planning. (See statement on Urban Planners.) Specialists in *physical geography* study the earth's physical characteristics. *Regional geography* pertains to all the physical, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin or an island, to a State, a country, or even a continent. Geographers in the field of *cartography* design and construct maps, as well as compile data for them.

Many professional workers in the field have job titles which describe their specialization, such as cartographer, map cataloger, or regional analyst, rather than the title geographer. Others have titles relating to the subject matter of their study, such as photo-intelligence specialist or climatological analyst. Still others have titles such as community planner, market or business analyst, or intelligence specialist. Most of those who teach in colleges and universities are called geographers.

### Where Employed

An estimated 3,500 geographers were employed in the United States in 1967; about 10 percent were women.

Approximately two-thirds of all geographers are employed by colleges and universities. Those teaching in institutions which do not have separate departments of geography usually are associated with departments of geology, economics, or other physical or social sciences.

The Federal Government employs a large number of geographers. Among the major agencies employing these workers are the Army Map Service; the Central Intelligence Agency; the Defense Intelligence Agency; the Office of Geography of

the Department of the Interior; and the Environmental Sciences Services Administration. State and local governments also employ a number of geographers, mostly on city and State planning and development commissions.

Most of the relatively small but growing number of geographers employed by private industry work for marketing research organizations, map companies, textbook publishers, travel agencies, manufacturing firms, or chain stores. A few geographers work for scientific foundations and other nonprofit organizations and research institutes.

### Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in geography usually is a bachelor's degree with a major in the field. For most positions in research and teaching, and for advancement in many other types of work, graduate training is required.

Training leading to the bachelor's degree in geography was offered by about 200 colleges and universities in 1967. Undergraduate study usually provides a general introduction to geographic knowledge and research methods and often includes some field studies. Typical courses offered are physiography, weather and climate, economic geography, political geography, urban geography, and regional courses, such as geography of North America, Western Europe, the U.S.S.R., and Asia. Courses in cartography and in the interpretation of maps and aerial photographs are offered also.

Advanced degrees in geography are offered by a relatively small number of schools. In 1967, master's degrees were awarded by about 90 institutions and Ph. D. degrees by about 40. For admittance to a graduate program in geography, a bachelor's degree with a major in geography is the usual requirement.

However, most universities admit



Geographer transfers regional information to map.

students with bachelor's degrees in such fields as economics, geology, or history, if they have a good background in geography. Requirements for advanced degrees include field and laboratory work, as well as classroom studies and thesis preparation.

New graduates with only the bachelor's degree in geography usually find positions connected with making, interpreting, or analyzing maps, or in research, either working for the government or private industry. Others enter beginning positions in the planning field. Some obtain employment as research or teaching assistants in educational institutions while studying for advanced degrees. New graduates with the master's degree can qualify for some teaching and research positions in colleges and for many research positions in government and private industry. The Ph. D. degree is usually required for high-level posts in college teaching and research and may be necessary for advancement to top-level positions in other activities.

### Employment Outlook

The employment outlook for geographers is likely to be favorable through the 1970's. The demand will be especially strong for geographers having graduate degrees to fill research and teaching positions in colleges and universities and research jobs in industry and government. Geographers with advanced training in such fields as economics or business administration will also be in strong demand.

Colleges and universities are expected to offer the greatest number of employment opportunities as college enrollments increase sharply in the early 1970's. Rising interest in foreign countries, and growing awareness of the value of geography training in several other fields of work such as the foreign service, should also result in increased enrollments in geography and in a need for additional teachers at the college level. A growing demand for geography

teachers in secondary schools is also anticipated.

Employment of geographers in government is also likely to increase. The Federal Government will need additional personnel in positions related to regional development; urban planning; resource management; planning, construction, and interpretation of maps; and in intelligence work. State and local government employment of geographers will expand also, particularly in such areas as conservation, highway planning, and city, community, and regional planning and development.

The number of geographers employed in private industry is also expected to rise. Market research and location analysis should continue to grow rapidly. Opportunities should also increase in private area planning and development work.

Since geography is a relatively small field, job openings are not expected to be numerous in any one year. However, unless the number of persons receiving degrees in the field should grow far beyond current expectations, qualified geographers, particularly those with advanced degrees, should find employment readily through the 1970's.

Employment prospects for women geographers will be best in teaching, especially in junior colleges, women's colleges and in the larger co-educational institutions. Government agencies should also offer good opportunities for women in mapping and planning work.

### Earnings and Working Conditions

In the Federal Government in early 1967, geographers having the bachelor's degree and no experience could start at \$5,331 or \$6,451 a year, depending on their college record. Inexperienced geographers with 1 or 2 years of graduate teaching could start at \$6,451 or \$7,696; and those having the Ph. D. degree, at \$9,221.

In colleges and universities, salaries of geographers depend on their teaching rank. (For further informa-

tion, see statement on College and University Teachers.) Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research projects, and publication of books and articles.

Working conditions of most geographers are similar to those of other teachers and office workers. Geographic research frequently requires extensive travel, in foreign countries as well as in the United States.

### Where To Go for More Information

Association of American Geographers,  
1146 16th St. NW., Washington, D.C.  
20036.

### HISTORIANS

(D.O.T. 052.088)

#### Nature of Work

Historians study the records of the past and write books and articles describing and analyzing past events, institutions, ideas, and people. They may use their knowledge of the past to explain current events. They may specialize in the history of a specific country or region, or in a particular period of time—ancient, medieval, or modern—or in economic, cultural, military, or other phases of history. More historians specialize in either United States or modern European history than in any other field; however, a growing number are now specializing in African and Latin American history. Some are experts in such fields as the history of the labor movement, art, architecture, or other fields of historical interest. The number of specialties is constantly growing. The history of business and the relation between technological changes and other aspects of historical development are among the newest fields.

Most historians are college teachers who also do some research, writing, and lecturing. Some, called *archivists*,

specialize in identifying, preserving, and making available documentary materials of historical value. Others edit historical materials, prepare exhibits, write pamphlets and handbooks, and give talks for museums, special libraries, and historical societies. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Historians employed in government mainly do research and administrative work in connection with research projects; they also prepare studies, articles, and books.

### Where Employed

About 10,000 persons were estimated to be employed as historians in 1967. Approximately 85 percent of all historians were employed in colleges and universities. About 10 percent were employed in Federal Government agencies, principally the National Archives and the Departments of Defense, Interior, and State. Small but growing numbers were employed by other government organizations (State, local, and international), non-profit 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 in the Federal Government, including three-fourths of those working as archivists, 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 for qualification as a historian. A master's degree in history is the minimum requirement for appointment to the position of college instructor, but in many colleges and



universities, a Ph. D. degree is necessary for appointment. The latter is essential 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.

Although a bachelor's degree with a major in history is sufficient training for some beginning jobs in Federal, State, and local governments, persons in such jobs may not be regarded as professional historians. These beginning jobs are likely to be concerned with the collection of and preservation of historical data, so that a knowledge of archival work is helpful. An undergraduate major in history is considered helpful for jobs in international relations and journalism.

### Employment Outlook

Employment in this relatively small occupation is expected to continue to increase rapidly through the 1970's. Hundreds of new history teachers will probably be needed annually to teach new classes made necessary by expanding college enrollments, and to replace those faculty members who retire, die, or leave for other types of work. The number of positions for historians in archival work is also expected to rise, although 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 through the 1970's. Historians who have completed all requirements for the Ph. D. except the dissertation are also expected to have favorable opportunities. However, those with no work beyond the master's degree will probably encounter considerable competition for professional positions. College graduates with only the bachelor's degree will find it difficult to obtain employment

as professional historians. On the other hand, history majors who meet certification requirements will find 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.

### Earnings

The average (median) salary of historians employed by colleges and

universities was \$12,600 in 1966; assistant professors averaged \$10,500; associate professors, \$13,000; and professors, \$16,000. Salaries tended to be lower for those persons employed in junior colleges and teacher's colleges.

In the Federal Government, the starting salary for persons with a bachelor's degree was \$5,331 in early 1967. Those with a superior academic record or with a year of graduate training were eligible for positions at an annual salary of \$6,451. Most of the experienced historians in the Federal Government earned from \$7,500 to \$15,000 a year in early 1967.



Archivist searches historical documents.

Some historians, particularly those in college teaching, supplement their income by summer teaching or writing books or articles. A few earn additional income from lectures.

### Where To Go for More Information

Additional information on employment opportunities for historians may be obtained from:

American Historical Association,  
400 A St. SE., Washington, D.C.  
20003.

## POLITICAL SCIENTISTS

(D.O.T. 051.088)

### 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.

Political scientists are most frequently employed as college and university teachers, sometimes teaching other social sciences as well. They may combine research, consultation, or administrative duties with their teaching. Some teach in foreign universities where they prepare students for careers in public administration and assist in the development of training programs for government personnel. Many political scientists are engaged mainly in research. They may make surveys of public opinion on political questions for private research organizations. They may study proposed legislation for State or municipal legislative reference bureaus or congressional committees to determine whether the legislation is well drafted

and constitutional. Others may analyze the operations of government agencies or specialize in foreign affairs research, either for government or nongovernment organizations. Still others are engaged in administrative or managerial duties. Some work in budget analysis, personnel, and urban planning or as legislative aids to congressmen, and as staff members of congressional committees.

### Where Employed

Approximately 9,000 people were employed as political scientists in 1966, largely in colleges and universities or in government agencies. Fewer than 10 percent worked for other types of employers such as municipal and other research bureaus, civic and taxpayers associations, and large business firms.

Political scientists are employed in nearly every college in the United States, since courses in political science or government are widely taught. Most other political scientists are located in Washington, D.C., and in other large cities, or in State capitals. Some are employed in overseas jobs, mainly by the U.S. Department of State, particularly for positions with the Agency for International Development, and the U.S. Information Agency.

### Training and Other Qualifications

Graduate training generally is required for employment as a political scientist. College graduates holding 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 80 colleges and universities offer graduate degrees in public administration. The college programs cover a wide range of subjects—for example, international administration, city planning, municipal administration, criminal investigation, and so-

cial security administration. A majority of the schools provide field training, and many offer internships which enable the student to obtain experience in government work. Many universities award graduate degrees in international relations, foreign service, and area studies, as well as political science in general. 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 Government jobs, such as those with the Agency for International Development, only persons who have had 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 holding only a bachelor's degree in political science may qualify as trainees in public relations or research work, or in jobs such as budget analyst, personnel assistant, or investigators in government or industry. Many students holding the bachelor's degree in political science go on to study law; others obtain graduate training in public administration, international relations, or other specialized branches of political science.

### Employment Outlook

Employment of political scientists will probably increase rapidly throughout the 1970's. The greatest increase will be in colleges and universities. The number of political scientists in administrative jobs in government agencies will probably rise also because of a growing recognition of the value of specialized training in developing and planning new programs. Government agencies concerned with foreign affairs will continue to employ many political

scientists. A slow growth is anticipated in employment of political scientists in private industry. In addition to those required to staff new positions, many political scientists will be needed to fill positions vacated because of retirements, deaths, or transfers to other fields of work.

The number of political scientists having a doctoral degree is expected to rise less rapidly than demand. As a result, new Ph. D. graduates will find very good opportunities in college teaching and good chances for employment in other fields as well. Those who have completed all the requirements for the doctorate except the dissertation are also likely to find favorable opportunities in college teaching. Employment opportunities for those having the master's degree will be more limited, but openings will be available to them in Federal, State, and municipal government agencies; research bureaus; political organizations; and civic and welfare agencies. For new graduates with only the bachelor's degree, opportunities for employment in the political science field will probably continue to be very limited. However, those planning to continue their studies in law, foreign affairs, journalism, and other related fields will find their political science background very helpful. Some who meet State certification requirements will be able to enter high school teaching.

### Earnings

The average (median) salary for political scientists, employed by colleges and universities was \$12,600 a year in 1966; assistant professors averaged \$10,500; associate professors, \$13,000; and professors, \$16,000. Salaries tended to be lower for those persons employed in junior colleges and teachers colleges. Generally, those persons holding the doctorate had the higher salaries.

In the Federal Government, the starting salary for political scientists having a bachelor's degree was

\$5,331 a year in early 1967. Those having a superior academic record or a year of graduate training were eligible for positions at an annual salary of \$6,451. Most of the experienced political scientists in the Federal Government earned considerably more.

Some political scientists, particularly those in college teaching, supplement their income by doing summer teaching or consulting work.

### Where To Go for More Information

Additional information on employment opportunities in political science and public administration may be obtained from the following organizations:

American Political Science Association,  
1527 New Hampshire Ave. NW.,  
Washington, D.C. 20036.

American Society for Public Administration,  
1329 18th St. NW., Washington,  
D.C. 20036.

### SOCIOLOGISTS

(D.O.T. 054.088)

#### Nature of Work

Sociologists study the many groups which man forms—families, tribes, communities, and States, and a great variety of social, religious, political, business, and other organizations which have arisen out of living together. They study the behavior and interaction of these groups, trace their origin and growth, and analyze the influence of group activities on individual members. Some sociologists are primarily concerned with the characteristics of social groups and institutions; others are more interested in the ways in which individuals are affected by groups to which they belong. Many work in the field of social organization, social psychology, or rural sociology. Others specialize in inter-

group relations, family problems, social effects of urban living, population studies, or analyses of public opinion. Some 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, education, public relations in industry, and regional and community planning. A few specialize in medical sociology—studying the social factors which affect the fields of mental and public health.

Most sociologists are college teachers, but, as a rule, these teachers also conduct research. Sociological research often involves the collection of data, preparation of case studies, testing, and the conduct of statistical surveys and laboratory experiments. Sociologists may study individuals, families, or communities in an attempt to discover the causes of social problems—such as crime, juvenile delinquency, or poverty; the normal pattern of family relations; or the different patterns of living in communities of varying types and sizes. They may collect and analyze data from official government sources to illustrate population trends, including changes in age, sex, race, and other population characteristics; and also the extent of population movement among rural, suburban, and urban areas and among different geographic areas. Sociologists may conduct surveys, either those which add to basic sociological knowledge or those which may be applied in such fields as public opinion research, marketing, and advertising research. Others are specialists in the use of mass communication facilities, including radio, television, newspapers, magazines, and circulars.

Sociologists are sometimes administrators—supervising research projects or the operation of social agencies, including family and marriage clinics. Other sociologists act as consultants, advising on such diverse problems as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or the

development of effective advertising programs to promote public interest in particular products.

### Where Employed

It is estimated that between 4,500 and 5,500 persons were employed as sociologists in 1967. Numerous other persons were employed in positions requiring some training in this field, including many in social, recreation, and public health work.

Approximately seven-tenths of all sociologists are employed in colleges and universities. Almost one-tenth are in Federal, State, local, or international government agencies; the remainder work in private industry, in welfare or other nonprofit organizations, or are self-employed.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities which offer graduate training in sociology and opportunities for employment in research. Medical sociologists are most often employed on the teaching or research staffs of medical colleges and their graduate departments of public health and preventive medicine. They also find employment on hospital staffs and in State and municipal health departments. Rural sociologists most frequently work at State universities where they are likely to have opportunities for research at the State agricultural experiment stations attached to these universities. Some specialists in rural sociology and community development are employed in foreign countries by U.S. Government agencies and private foundations.

### Training, Other Qualifications, and Advancement

A master's degree with a major in sociology is usually the minimum required for employment as a sociologist. The Ph. D. degree is essential

for attaining a professorship in most colleges or universities, and is commonly required for directors of major research projects, important administrative positions, or consultants.

Sociologists with master's degrees may qualify for many administrative and research positions, provided they are trained in research methods and statistics. They may perform work requiring responsibility for specific portions of a survey or for the preparation of analyses and reports under general supervision. As they gain experience, they may advance to supervisory positions in both public and private agencies. Sociologists with the master's degree may qualify for some college instructorships. Most colleges, however, appoint as instructors only people with training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students can often get teaching or research assistantships which will provide both financial aid and valuable experience.

Young people with only a bachelor's degree in sociology are not usually recognized by the profession as sociologists, although they may be able to secure other jobs in this or related fields. They may get jobs as interviewers or as research assistants working under close supervision. Many are employed as caseworkers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. Sociology majors with sufficient training in statistics may obtain positions as beginning statisticians. Those who meet State certification requirements may enter high school teaching.

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 through the 1970's. Because of expanding enrollments, the majority of new positions will be in college teaching. However, some openings will result from the growing trend to include sociology courses in the curriculums of other professions, such as medicine, law, and education. An estimated 300 teachers may be needed each year, on the average, to fill new positions and to replace college faculty members who leave the profession. A substantial rise in the number of sociologists in nonteaching fields is anticipated to cope with social and welfare problems and to implement educational and social legislation designed to develop human resources.

Sociologists well trained in research methods and advanced statistics will have the widest choice of jobs. Employment opportunities are also expected to be very good for research workers in rural sociology, community development, population analysis, public opinion research, and various branches of medical sociology. Employment opportunities will also increase in other applied fields, such as the study of juvenile delinquency and education. Some openings are anticipated in a relatively new area, the sociology of law.

The number of sociologists holding the doctor's degree is expected to rise less rapidly than the number of positions through the 1970's. As a result, employment opportunities for both Ph. D.'s, and those who have completed all requirements for the doctorate except the dissertation, will probably be very good during this period. Inexperienced 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.

### Earnings

Sociologists in teaching—where most are employed—averaged \$11,300 annually in 1966. In comparison, those working for nonprofit organizations or in industry averaged \$14,000 and \$15,000, respectively; in the Federal Government, those with experience averaged \$14,700.

In the Federal Government, the beginning salary in early 1967 for sociology majors with a bachelor's degree was \$5,331. Those with a superior academic record or a year of graduate training were eligible for positions at an annual salary of \$6,451. Starting salaries were higher for candidates with additional graduate training.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those with the master's degree. Many sociologists supplement their regular salaries with earnings from other sources. Summer teaching and consulting work are the principal sources of income. Sociologists employed by colleges and universities are the most likely to have additional earnings.

## TEACHING

Teaching is the largest of the professions. About 2.3 million men and women were full-time teachers in the Nation's elementary schools, secondary schools, and colleges and universities in the 1966-67 school year. In addition, thousands of others taught part time. Among these were many scientists, physicians, accountants, members of other professions, and graduate students. Similarly, large numbers of craftsmen taught part time in vocational schools. Many other people instructed students in adult education and recreation programs.

No other profession offers so many employment opportunities for women. Almost 1½ million women are teachers, more than twice the number employed in nursing, the second largest field of professional employment for women. Women teachers far outnumber men in kindergarten and elementary schools and hold slightly less than half the teaching positions in secondary (junior and senior high) schools, but only about one-fourth of all college and university teaching positions.

The number of teachers needed by the Nation's schools depends chiefly on the number of students enrolled. At the beginning of the 1966-67 school year, 56 million people—more than one-fourth of the country's total population—were enrolled in the Nation's schools and colleges. Through the mid-1970's, continued growth of

the high school and college population and continued increases in high school and college attendance rates are expected to produce a rise in high school enrollments and an impressive rate of increase in college enrollments. On the other hand, enrollments at the elementary school level are not expected to increase further as a result of recent declines in the birth rate; however, these enrollments will remain high. Total enrollments in all schools and colleges combined, according to U.S. Office of Education estimates, may increase to about 63 million by 1975.

To staff the new classrooms that must be provided for the rising numbers of students, and to allow for a continuing improvement in the student-teacher ratio below the college level, the Nation's full-time teaching staff in 1975 will need to be about a fifth or about 435,000 larger than in 1966. In addition, a much greater number of teachers—perhaps as many as 1.7 million—will be required to replace those who leave the profession. Many new teachers will be needed in elementary and secondary schools if the ratios between pupils and teachers are to be reduced significantly beyond current expectations. Moreover, additional teachers will be required to replace those who do not meet the minimum standards for certification.

The outlook for teachers at each educational level—in elementary and secondary schools, and also in colleges and universities—is discussed in the following statements.

### KINDERGARTEN AND ELEMENTARY SCHOOL TEACHERS

(D.O.T. 092.228)

#### Nature of Work

Elementary school teaching is the largest field of professional employment for women and is also a growing field for men. In the 1966-67 school

year, about 1.2 million kindergarten and elementary teachers were employed. In addition, an estimated 60,000 principals and supervisors were employed in public and private elementary schools.

Kindergarten teachers conduct a program of education for young children. Most frequently, they divide the schoolday between two groups, teaching two different classes a day. Some, however, may work with one group all day. They expose children to experiences in play, music, artwork, stories, and poetry; and introduce them to science, numbers, language, and social studies. In a variety of ways, kindergarten teachers help to develop children's curiosity and zeal for learning as well as to stimulate their ability to think. After school hours, kindergarten teachers may plan the next day's work, study and prepare the children's school records, confer with parents or professional personnel concerning individual children, participate in teachers' in-service activities, and locate and become familiar with teaching resources. Programed instruction, including teaching machines and "talking typewriters," and the increasing use of teacher aids are new developments that are freeing many teachers from routine duties and allowing them to give more individual attention to their students.

Elementary school teachers usually work with one group of pupils during the entire schoolday, teaching several subjects and supervising various activities, such as lunch and play periods. In some school systems, however, teachers in the upper elementary grades may teach several groups of children in one or two subjects. Many school systems also employ special teachers to give instruction and to assist classroom teachers in certain subjects, such as art, music, physical education, industrial arts, foreign languages, and homemaking. Teachers in schools which have only a few students, largely in rural areas, may be required to teach all subjects in several grades.

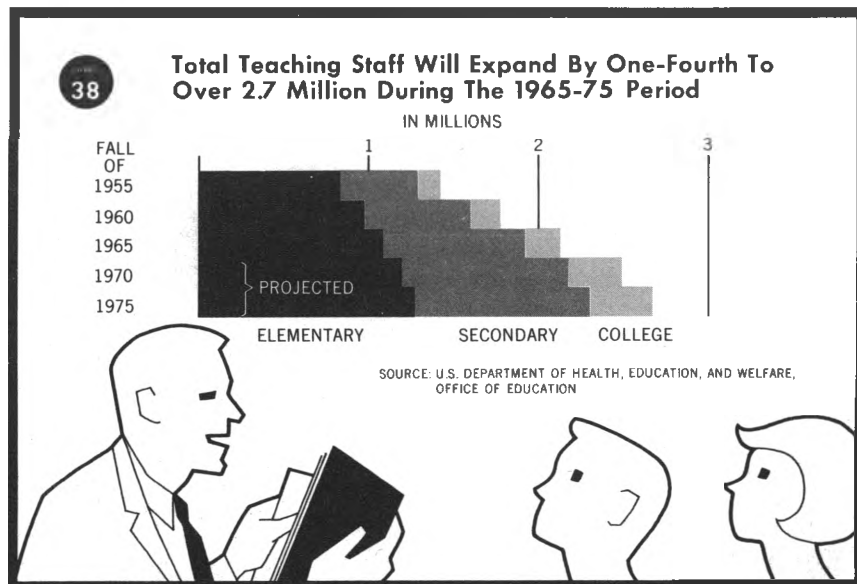
### Where Employed

Elementary school teachers are employed in all cities, towns, villages, and in rural areas. As a result of reorganization of school districts, many teachers are employed in consolidated schools in small towns. Only about 10,000 teach in one-room schools. Kindergarten teachers are employed primarily in the large urban areas.

### Training, Other Qualifications, and Advancement

All States require every teacher in the public schools to have a certificate. Several States have this same requirement for teachers in parochial and other private elementary schools.

In 1966, 46 States and the District of Columbia issued regular teaching certificates only to persons with at least 4 years of approved college preparation. Most States also require that teachers have a number of professional education courses. Eighteen States require at least 5 years of preparation for certification. Ten States specify the number of years within which the higher degree is to be attained. Some school systems have higher educational requirements than those for State certification.



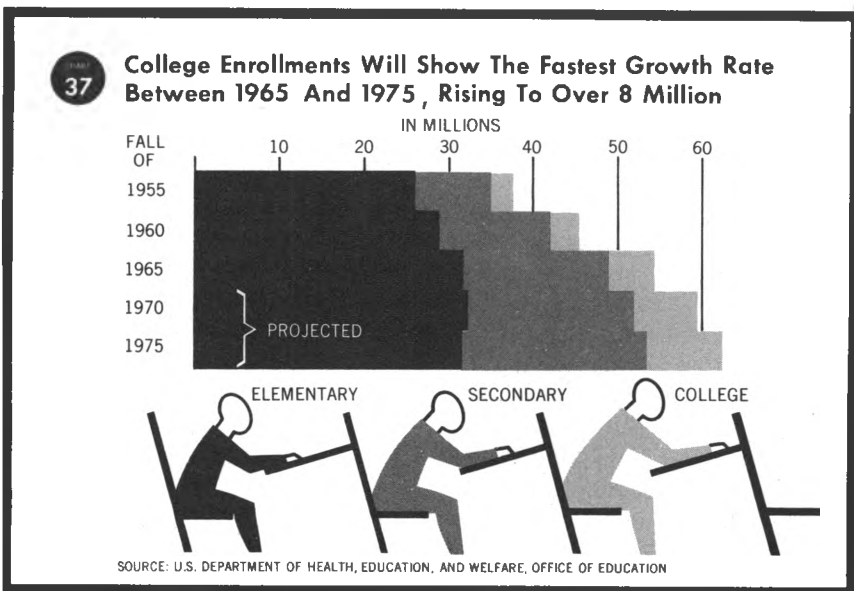
In nearly all States, certificates are issued by State departments of education on the basis of transcripts of credits and recommendations from approved colleges and universities. Certificates may be issued to teachers from other States if the prescribed programs have been completed at accredited colleges or if the teachers meet the academic and personal requirements of the State to which they are applying. Under certain conditions, usually related to a shortage of qualified teachers, most States will

issue emergency or temporary certificates to partially prepared teachers. However, these teachers must have their certificates renewed every year until all requirements for regular certificates have been met.

All States have certain additional requirements for public school teaching. For example, they may require a health certificate, evidence of citizenship, or an oath of allegiance. The prospective teacher should find out about the specific requirements of the area in which he plans to work by writing to the State department of education or to the superintendent of the local school system.

Most institutions of higher education offer teacher preparation. In a 4-year teacher-preparation curriculum, prospective elementary school teachers spend about one-fourth of the time in professional courses—learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school situation; the remainder of their time is devoted to studying liberal arts subjects. Some study of the process of learning and human behavior is usually included.

After gaining experience, teachers will find opportunities for advancement through annual salary increases





in the same school system; by 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 in the school system; or by transferring to higher levels of teaching for which their training and experience may qualify them.

Among the most important personal qualifications for elementary school teaching are an enjoyment and understanding of children. Teachers must be patient and self-disciplined, and have high standards of personal conduct. A broad knowledge and appreciation of the arts, sciences, history, and literature also are valuable. Civic, social, and recreational activities of teachers may be influenced, and sometimes are restricted, by the customs and attitudes of their com-

### Employment Outlook

Young people preparing to teach in elementary schools will find a large number of teaching positions available—an estimated 925,000 between 1967 and 1975. About 825,000 will be needed to replace those who retire, die, or leave the profession for other reasons. An estimated 100,000 will be required to improve the pupil-teacher ratio. In addition, about 56,500 teachers will be needed to replace persons not meeting certification requirements.

The leveling of enrollments in elementary schools that is expected over the next few years may be accompanied by an increase in the number of college graduates qualified to teach. If present teacher training trends continue, the supply of newly trained teachers available for elementary teaching will increase significantly by the mid-1970's. Since

the relative number of teachers is expected to be greater than that of previous decades, young people seeking their first teaching assignment are likely to find the schools placing greater emphasis on quality of applicants' training and academic accomplishment. Nevertheless, even if supply expands as the trends suggest, the demand may exceed the supply in certain geographic areas, where teaching salaries are low and better paying opportunities are available in other fields in the community. The Elementary and Secondary Education Act of 1965, and the Higher Education Act of 1965, as amended, place special emphasis on aid to preschoolers, children in low-income areas, the mentally retarded, and other groups requiring special attention. Thus, additional kindergarten and elementary teachers may be needed, adding considerable pressure to the demand for teachers. For ex-



ample, the National Teacher Corps (federally recruited teachers and teacher-interns for low-income areas) is expected to enroll many teachers in the next few years, as are the rising number of kindergarten programs.

### Earnings and Working Conditions

The average salary for classroom teachers in public elementary schools, according to National Education Association (NEA) estimates, was \$6,609 in 1966-67. In the three highest paying States (California, New York, and Hawaii) teachers' salaries averaged \$7,600 or more; in the seven States with lowest salaries (Alabama, Arkansas, Kentucky, Mississippi, North Dakota, South Dakota, and South Carolina), they were less than \$5,300. An increasing number of States (31 in the 1966-67 academic year) are establishing minimum salary levels.

Although the time spent in the classroom (fewer than 6 hours) is usually less than the average workday in most other occupations, the elementary school teacher must spend additional time each day giving individual help, 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.

Since most schools are in session fewer than 12 months a year, teachers often work at other jobs or take courses for professional growth during the summer. Some school systems, however, are extending the teachers' working year to 12 months, including a 1-month vacation in the summer.

Employment in teaching is steady and usually is not affected by changes in business conditions. Tenure provisions protect teachers from arbitrary dismissal. Pension and sick leave plans are common, and a growing number of school systems grant other types of leave with pay. An increas-

ing number of teachers are being represented by unions that bargain collectively for them on wages, hours, and other conditions of employment.

### Where To Go for More Information

Information on schools and certification requirements is available from the State department of education at each State capital.

Information on the National Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare,  
Office of Education, Washington,  
D.C. 20202.

Other sources of general information are:

American Federation of Teachers,  
716 North Rush St., Chicago, Ill.  
60611.

National Commission on Teacher Education and Professional Standards,  
National Education Association,  
1201 16th St. NW., Washington,  
D.C. 20036.

## SECONDARY SCHOOL TEACHERS

(D.O.T. 091.118 through .228)

### Nature of Work

Secondary school teachers—those employed in junior and senior high schools—usually specialize in a particular subject. They teach several classes every day, either in their main subject, in related subjects, or both. 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 some fields, such as home econom-



ics, agriculture, commercial subjects, driver education, music, art, and industrial arts, less frequently conduct classes in other subjects. The choice of teaching method usually is left to the teacher. Depending on the subject and students' needs and aptitudes, it may vary from formal lecturing to free discussions.

Besides giving classroom instruction, secondary school teachers develop and plan teaching materials, develop and correct tests, keep records, make out reports, consult with parents, supervise study halls, and perform other duties. The growing use of teaching machines, programmed instruction, and teacher aides relieves the teacher of many routine tasks. Many supervise student activities, such as clubs and social affairs—sometimes after regular school hours. Maintaining good relations with parents, the community, and fellow teachers is an important aspect of their jobs.

About 850,000 teachers were employed in the Nation's public and private secondary schools in 1966-67. Slightly more than half the classroom teachers in public secondary schools were men. Men far outnumber women in supervisory and administrative positions in both public and private schools.

### Where Employed

The number of grades in secondary schools depends on how the local school system is organized. Many secondary school teachers are employed in 6-year combined junior-senior high schools (grade 7-12); many teachers are in separate junior high schools of either two or three grades (7-8 or 7-9); and the remainder teach in 4-year high schools (grades 9-12) and in senior high schools (grades 10-12).

### Training, Other Qualifications, and Advancement

In every State, a certificate is required for public secondary school

teaching. To qualify for this certificate, the prospective teacher must have at least the equivalent of one-half year of education courses, including practice teaching, plus professional courses in one or more subjects commonly taught in secondary schools.

Ten States require a fifth year of study or qualification for a master's degree within a specified period following the teacher's beginning employment. 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 about one-third of the 4-year course to their major, which may be in a single subject or a group of related subjects. About one-sixth of the time is spent in education courses—learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school situation. The remaining time is devoted to general or liberal arts courses. Accepted 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 preparing to meet its additional requirements.

Qualified secondary school teachers may advance to department heads, supervisors, assistant principals, principals, superintendents, or other administrative officers as openings occur. At least 1 year of professional education beyond the bachelor's degree and several years of successful classroom

teaching are required for most supervisory and administrative positions. Often, a doctorate is required for appointment as superintendent. A few experienced teachers are assigned as part- or full-time guidance counselors, to teach in the pupils' homes or to instruct handicapped or other special groups. Usually, additional preparation and sometimes special certificates are required for these assignments.

Probably the most important personal qualifications for secondary school teaching are an appreciation and understanding of adolescent children. Patience and self-discipline are desirable traits, as are high standards of personal conduct. In addition to an enthusiasm for the subjects they teach, a broad knowledge and appreciation of the arts, sciences, history, and literature also are desirable. Civic, social, and recreational activities of teachers may be influenced, and sometimes restricted, by the customs and attitudes of their community.

### Employment Outlook

About 900,000 new secondary school teachers will be needed between 1967 and 1975 to take care of enrollment increases, to reflect some improvement in the pupil-teacher ratio, and to replace teachers who retire, marry, or leave the field for other reasons. An additional 34,000 will be needed to replace persons who do not meet certification requirements. Although some job openings for secondary school teachers will be created by rising enrollments, most of the job openings—over 70 percent of the total requirements—will come from the need to replace teachers who for various reasons may leave the field.

A slowing down in the rate of enrollment growth in secondary schools may be accompanied by a simultaneous increase in the number of college graduates trained for teaching. If the total number of degrees awarded increases as projected by the U.S. Office of Education, and if the propor-

tion of graduates prepared to teach in secondary schools continues to be about the same as in the past through the mid-1970's, the total number of new graduates available for secondary school teaching positions will increase significantly. In addition to newly trained teachers, many reentries in the profession also will be available to fill teacher vacancies. Thus, it is likely that new graduates may face increasing competition for entry positions in secondary teaching. Young people planning to teach, therefore, are likely to find school boards placing much greater emphasis on the nature of applicants' professional training and academic performance. Even with an improvement in the supply situation, however, opportunities will be very favorable in some geographic areas and in some subject fields, such as physical and biological sciences and mathematics, for which the demand in private industry and government is also great. Further specialized training may qualify many teachers who are trained for secondary school teaching for positions in vocational and technical schools, and junior colleges, where demand for teachers is expected to be especially great in the years to come. Also, considerable additional demand for teachers may be generated by Federal legislation that provides for supplementary educational centers and services and a Teacher Corps. These extensive additions to present teaching services will be available to both public and private school children.

### Earnings and Working Conditions

The average annual salary for all classroom teachers in public secondary schools was about \$7,095 in 1966-67 according to estimates by the National Education Association. In California and New York, average salaries exceeded \$8,000; the average was less than \$5,700 in three States, Arkansas, Mississippi, and South Dakota. At the beginning of the 1966-67

academic year, 31 States had minimum teacher salary laws.

Junior high school teachers frequently receive lower salaries than high school teachers in the same school system. Teachers of vocational education, physical education, and other special subjects often receive higher salaries than do other teachers in the same school. Under salary schedules in effect in most school systems, teachers in all subject fields get regular salary increases as they gain experience and additional education.

Teachers' salaries are usually lower in towns and small cities than in larger cities or suburbs, but higher educational and experience requirements are likely to prevail in large city school systems. On the average, salaries of principals in the largest cities, where administrative responsibilities are great, are much higher than in towns and small cities. Salaries of superintendents are \$30,000 or more in many large school systems.

Teachers often add to their incomes by teaching in summer school, working as camp and recreational counselors, or doing other work. Some teachers supplement their incomes during the regular school year. They may teach in adult or evening classes, work part-time in business or industry, or write for publication.

Some form of retirement 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.

According to a recent survey, the average workweek of secondary school teachers is about 46 hours a week, of which 23½ hours are spent in classroom instruction and the remainder in out-of-class instruction and other duties. An increasing number of teachers is being represented by unions that bargain collectively for them on wages, hours, and other conditions of employment.

### Where To Go for More Information

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

Information on the National Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare,  
Office of Education, Washington,  
D.C. 20202.

Other sources of information are:

American Federation of Teachers,  
716 North Rush St., Chicago, Ill.  
60611.

National Commission on Teacher  
Education and Professional  
Standards,  
National Education Association,  
1201 16th St. NW., Washington,  
D.C. 20036.

### COLLEGE AND UNIVERSITY TEACHERS

(D.O.T. 090.168 and .228)

#### Nature of Work

About 400,000 college teachers were employed in the Nation's 2,300 colleges and universities in the 1966-67 academic year. About 265,000 were teaching full time. Another 130,000 were teaching part time in medicine, law, business administration, and other professional fields. Other faculty members were employed in administration, full-time research, or other educational activities. Men predominated in most college teaching fields and held at least 95 percent of the positions in engineering, the physical sciences, agriculture, and law. Only about one-fourth of all college and university teachers were women; however, the majority of teachers in nursing, home economics, and library science were women.

College and university teachers instruct students in specific subjects. More than half teach courses in the

social sciences, fine arts, English and journalism, the physical sciences, biological sciences, education and related fields, 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 also serve as advisors to graduate students and who are actively engaged in research—may spend only 6 or 8 hours a week in actual classroom work. In the universities, graduate students often teach freshmen classes under the direction of a regular faculty member. Many introductory courses also use educational television which relies upon well-qualified teachers who specialize in a particular subject. Besides teaching classes, college teachers prepare tests and other materials for classroom use, check and grade students' work, advise students, and keep up to date with developments in their specialties. The increasing use of computers relieves college teachers to some extent of many routine tasks, such as scoring and grading objective tests. Therefore, they are able to devote more time preparing for lectures, providing individual assistance, and performing research activities. Many carry on research projects, write for publication, or aid in college administration. Some professors act as consultants to business, industrial, scientific, or government organizations.

### Where Employed

About three-fourths of all full-time college teachers were employed by public and nonpublic colleges and universities in the 1963-64 school year. An estimated 7 percent were employed by professional schools and 9 percent by less than 4-year institutions.

Some States have many more colleges and universities than others, partly reflecting differences in population size. About half of all college and university teachers are employed in eight States, each with college enrollments exceeding 200,000: New

York, California, Pennsylvania, Illinois, Massachusetts, Texas, Ohio, and Michigan.

### Training, Other Qualifications, and Advancement

To qualify for most beginning positions, applicants must have at least the master's degree, and for many, they must have completed all requirements for the doctorate except the dissertation. The doctor's degree is often required for promotion or appointment to positions above the rank of instructor. It is particularly important for teaching positions in the biological sciences, physical sciences, psychology, social sciences, philosophy, and religion; it is least likely to be a requirement in business and commerce, engineering, fine arts, health and physical education, and home economics. A number of States that maintain public junior colleges require State certification for teaching in these 2-year schools. To obtain such a certificate, a teacher must have received the master's degree and have taken certain courses in education.

To enter college teaching, specialization in some subject field is necessary. In addition, undergraduate courses in the humanities, social sciences, natural sciences, and the mastery of at least one foreign language are important. Intensive instruction in the selected field of specialization is given in graduate school. During their graduate work, outstanding students may be employed as part-time teaching or research assistants; such work affords valuable experience. 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 and junior colleges—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. Advancement to assistant and associate professorship is restricted generally to candidates who have extensive graduate training or teaching experience. A doctor's degree and many years of teaching experience—from 10 to 20 years—are usually required to become a full professor. A U.S. Office of Education survey indicates that about one-quarter of the teaching faculty are professors, another quarter associate professors, 30 percent are assistant professors, and about 18 percent are instructors. Outstanding achievement, generally through research or publications, hastens advancement. Because demand is particularly strong, teachers of some subjects, such as engineering, law, mathematics, medicine, and natural sciences, are sometimes appointed at higher ranks and at higher beginning salaries than other teachers who have comparable experience and education.

### Employment Outlook

College teaching opportunities are likely to be excellent for those who have doctoral degrees, and for those who have completed all requirements for the doctorate, except the dissertation. There also will be many employment opportunities for new entrants who have 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 is expected to rise by nearly 3.4 million between 1966 and 1975. At the same time, larger proportions of young people of college age will attend college—owing to rising family income, new Federal legislation to help needy college students, greater demand for college-trained personnel, and the increasing number and proportion of the population who finish high school. The anticipated increase in the number of community

colleges and schools offering evening classes will permit more young people and adults to attend college. If the proportion of young people attending college continues to increase and facilities are available, college enrollments will increase from about 6 million at present to almost 9 million by 1975, according to U.S. Office of Education projections.

Taking all these factors into account, the U.S. Office of Education estimates that the full-time college teaching staff will increase from its present size of 265,000 to 360,000 by 1975, an increase of 36 percent. In addition to the teachers needed to take care of the enrollment growth, an annual average of about 19,000 teachers may be needed by 1975 to replace those who retire, die, or leave the profession for other reasons.

The supply of new college teachers, which consists largely of students receiving graduate degrees, is also expected to grow. The U.S. Office of Education estimates that the number of doctorates conferred through 1975 will average about 27,000 a year, and the number of master's degrees about 180,000 annually. It is difficult, however, to say how many of these will enter teaching. According to the National Education Association in 1963-64 and 1964-65, fewer than half of the new teachers were graduate students the preceding year. In 1966-67, when the demand called for 37,000 new teachers, about 152,000 persons received graduate degrees; nevertheless, shortages of qualified teaching personnel were reported in several fields, particularly in the physical sciences, engineering, mathematics, and in some social science fields. Many of these new degree recipients were already employed when they received their degrees, and better paying opportunities may have attracted others to industry, government, and nonprofit organizations where demand for these graduates is very high.

The supply and quality of college teachers may be improved in the years ahead by recent Federal legis-

lation that makes fellowships available to qualified graduate students, and junior members of the faculty who are interested in teaching in colleges and universities. Nevertheless, the number of well-qualified persons available for teaching positions will continue to be insufficient to meet the demand in many subject fields through the 1970's.

### Earnings and Working Conditions

According to the American Association of University Professors (AAUP) average salaries of full-time instructional staff in colleges and universities were \$10,387 in 1966-67. The AAUP reported 1966-67 average salaries (9-10 months' basis) for full-time instructional personnel as follows:

Rank	Average salary (1966-67)
Professor . . . . .	\$14,402
Associate professor . . . . .	10,829
Assistant professor . . . . .	8,941
Instructor . . . . .	7,122

The National Education Association reported that median annual salaries for 9-10 months' work in 1965-66 were \$8,360 in public junior colleges and were \$6,407 in nonpublic junior colleges.

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

Some faculty members supplement their regular salaries with earnings from a variety of sources. The chief source is additional teaching (often in summer sessions). Consulting work may be a major source of extra income, particularly for teachers of engineering and physical sciences; research grants are now common, especially in many large, well-known universities; fees for lecturing and royalties on publications are other possible sources of income. Opportunities for additional income usually increase as the faculty member gains

recognition. For the majority of college teachers, additional income is small.

Retirement plans differ considerably among institutions, but an increasing number 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 normal retirement age, although most of these extend the age limit if desired.

Many colleges and universities provide benefits such as: Sabbatical leaves of absence—typically, 1 year's leave with half salary or a half-year's leave at full salary after 6 or 7 years of employment; other types of leave for advanced study; life, sickness, and accident insurance; reduced tuition charges or cash-tuition grants for children of faculty members; housing allowances; travel funds for attending professional meetings; 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,  
D.C. 20202.

American Association of University Professors,  
1785 Massachusetts Ave. NW.,  
Washington, D.C. 20036.

American Council on Education,  
1785 Massachusetts Ave. NW.,  
Washington, D.C. 20036.

American Federation of Teachers,  
716 No. Rush Street, Chicago, Ill.  
60611.

National Education Association,  
1201 16th St. NW., Washington,  
D.C. 20036.

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 elsewhere in the *Handbook*.

## TECHNICIAN OCCUPATIONS

Technician occupations are growing rapidly and, in recent years, the employment of technicians has been increasing faster than that of the engineers and scientists they assist. This growth stems from the needs of an expanding and increasingly technical economy and the growing recognition of the importance of technicians—factors which have greatly intensified the demand for technical workers. This chapter is concerned with the technicians who work with engineers and scientists, and with draftsmen, also usually considered technicians. Information on surveyors, often classified as technicians, and on technical occupations in the health field—including dental laboratory technicians, medical X-ray technicians, and dental hygienists—is presented elsewhere in the *Handbook*.

### ENGINEERING AND SCIENCE TECHNICIANS

(D.O.T. .002 through .029.)

#### Nature of Work

The term "technician," as used here, refers to technical workers whose jobs require both knowledge and use of scientific and mathematical theory; specialized education or training in some aspect of technology

or science; and who, as a rule, work directly with scientists and engineers. There is no generally accepted definition of the term "technician". For example, it is used by employers to refer to workers in a great variety of jobs, requiring a wide range of education and training. The term is applied to employees doing relatively routine work, to persons performing work requiring skills within a limited sphere, and to persons doing highly technical work, among them assistants to engineers and scientists.

The workers' job titles may be descriptive of their technical level (for example, junior engineer, biological aid, or engineering technician) or their work activity (for example, quality-control technician, production analyst, tool designer, materials tester, or time-study analyst). Some employers use the word "technician," preceded by adjectives, such as mechanical, electrical, electronics, or chemical, which describes areas of technology in which their personnel are employed.

The jobs of engineering and science technicians are more limited than those of the professional engineer or scientist, and have a greater practical orientation. Many technician jobs require the ability to analyze and solve engineering and science problems and to prepare formal reports on experiments, tests, or other projects. Some of these jobs require considerable aptitude in mathematics; others, the ability to visualize objects and to make sketches and drawings. Design jobs often require creative ability. Many technician jobs require some familiarity with one or more of the skilled trades, although not the ability to perform as a craftsman. Others demand extensive knowledge of industrial machinery, tools, equipment, and processes. Some jobs held by these technicians are supervisory and require both technical knowledge and the ability to supervise people.

In carrying out their assignments, engineering and science technicians frequently use complex electronic and mechanical instruments, experimental

laboratory apparatus, and drafting instruments. Almost all of the technicians whose jobs are described in this statement must be able to use engineering handbooks and computing devices, such as the slide rule or calculating machine.

Technicians engage in virtually every aspect of engineering and scientific work. In research, development, and design work, one of the largest areas of employment, they conduct experiments or tests; set up, calibrate, and operate instruments; and make calculations. They also assist scientists and engineers in developing experimental equipment and models by making drawings and sketches and, under the engineer's direction, frequently do some design work.

Technicians also work in jobs related to production, usually following a course laid out by the engineer or scientist, but often without close supervision. They may aid in the various phases of production operations, such as working out specifications for materials and methods of manufacture, devising tests to insure quality control of products, or making time-and-motion studies (timing and analyzing the worker's movements) designed to improve the efficiency of a particular operation. They may also perform liaison work between engineering and production or other departments.

Technicians often do work that might otherwise have to be done by engineers. They may serve as technical sales or field representatives of manufacturers; advise on installation and maintenance problems; or write specifications and technical manuals. (See statement on Technical Writers.)

The following sections describe a number of technological fields in which engineering and science technicians are trained and employed.

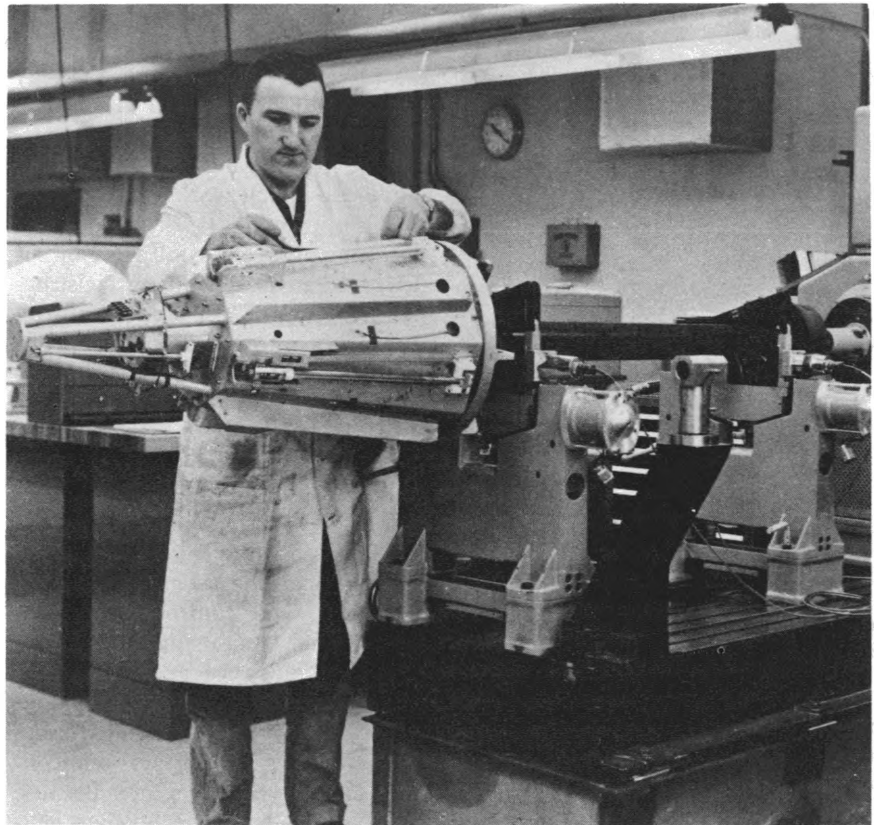
*Aeronautical Technology.* Technicians specializing in this area of technology work with engineers and scientists in many phases of the design and production of aircraft, helicopters, rockets, guided missiles, and

spacecraft. Many aid engineers in preparing layouts of structures, control systems, 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, or weight control. For example, under the direction of an engineer, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians working on engineering projects prepare or check drawings for technical accuracy, practicability, and economy.

Technicians sometimes help to estimate the cost of the materials and labor needed to manufacture aircraft and missiles. They may also be responsible for liaison between the engineers who do the planning and development work, and the craftsmen who convert the engineers' ideas into finished products. For example, as an aircraft or missile is built, the liaison technician checks it for conformance to specifications, keeps the engineer informed as to progress, and investigates any production engineering problems that arise. He sometimes recommends minor changes in the design, the materials, or the method of fabrication.

Other aeronautical technicians are employed as manufacturers' field service representatives, serving as the link between their company and the military, commercial airlines, and other customers. Technicians often prepare instruction manuals, bulletins, catalogs, and other technical materials. (See statements on Aerospace Engineers and Airplane Mechanics, and chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

*Air-Conditioning, Heating, and Refrigeration Technology.* Air-conditioning technology involves the control of air including its heating, cooling, humidity, cleanliness, and movement. Technicians in this field often become specialists in one area of work, such as refrigeration, and



Engineering technician examines ionosphere probe.

sometimes in a particular type of 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 may be assigned to such jobs as devising methods for testing equipment or analyzing production methods. Technically trained personnel also assist in designing the air-conditioning, heating, or refrigeration systems for a particular office, store, or other location and prepare instructions for their installation. In designing the layout for an air-conditioning or heating system, they must determine the cooling or heating requirements, decide what kind of equipment is most suitable, and estimate costs. Technicians employed as salesmen by equipment manu-

facturers must be able to supply contractors who design and install systems with information on such technical subjects as installation, maintenance, operating costs, and expected performance of equipment. (See also statement on Refrigeration and Air-Conditioning Mechanics.)

*Chemical Technology.* Technicians specializing in this area work mainly with chemists and chemical engineers in the development, production, sale, and utilization of chemical and related products and equipment. The field of chemistry is so broad that chemical technicians often become specialists in the problems of a particular industry, such as food processing, or in a particular activity, such as quality control.

Most chemical technicians work in research and development, testing, or other laboratory work. They conduct experiments and tabulate and analyze the results. In testing work, technicians make chemical tests of



**Chemical laboratory technician conducts routine test.**

materials to determine whether the materials meet specifications or whether particular substances are present and, if so, in what quantities. 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 such as the specific gravity and ash content of oil. Technicians employed in research or testing laboratories often assemble and use such apparatus and instruments as dilatometers (which measure the dilation or expansion of a substance), analytical balances, and centrifuges.

Outside the laboratory, chemical technicians are sometimes employed to supervise various operations in the production of chemical products and as technical salesman of chemicals and chemical equipment. (See also statements on Chemists and Chemical Engineers, and chapter on Occupations in the Industrial Chemical Industry.)

**Civil Engineering Technology.** Technicians trained in this area assist civil engineers in performing many of the tasks necessary in the planning and construction of high-

ways, railroads, bridges, viaducts, dams, and other structures. During the planning stage, technicians may help to estimate costs, to prepare specifications for materials, or participate in surveying, drafting, detailing, or designing work. Once the actual construction work has begun, they may assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See also statements on Civil Engineers, Draftsmen, and Surveyors.)

**Electronics Technology.** This field includes radio, radar, sonar, telemetering, television, telephony, and other forms of communication; industrial and medical measuring, recording, indicating, and controlling devices; navigational equipment; missile and spacecraft guidance and control instruments; electronic computers; and many other types of equipment using vacuum tubes, transistors, semiconductors, and printed circuits. Because the field is so broad, technicians generally become specialists in one area—for example, induction or dielectric heating, servomechanisms, automation controls, or ultrasonics.

Technicians working with engineers and scientists in the field of electronics do complex technical work that is more difficult than routine operating and repair work. (For additional information on broadcast technicians see chapter on Occupations in Radio and Television Broadcasting.)

**Industrial Technology.** Technicians trained in this area are sometimes called *industrial technicians* or *production technicians*. They assist industrial engineers on problems involving the efficient use of personnel materials, and machines in the production of goods or services. Their work includes preparing layouts of machinery and equipment, planning the flow of work, and making statistical studies and analyses of production costs. The industrial technician may also conduct time-and-motion studies.

In the course of their duties, many industrial technicians acquire experi-

ence 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. Still others may move into production supervision. (See statements on Personnel Workers and Industrial Engineers.)

**Mechanical Technology.** Mechanical technology is a broad term usually used to cover a large number of specialized fields, including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians in the above areas of mechanical technology often assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. They help to determine whether a proposed design change in a product is practical and how much the product will cost to produce. They may also be required to solve design problems such as those involving tolerances, stress, strain, friction, and vibration.

The planning and testing of experimental machines and equipment for performance, durability, and efficiency provide a large area of work for technicians. In the testing procedure, they record data, make computations, plot graphs, analyze results, and write reports. They sometimes make recommendations for design changes to improve performance. Their jobs often require skill in the use of instruments, test equipment and gages, such as dynamometers, as well as the ability to prepare and interpret drawings.

Some mechanical technicians are employed in manufacturing departments to help develop plans for testing and inspecting machines and equipment, or to work with engineers in eliminating production problems. Some obtain jobs as technical salesmen. (See statements on Mechanical



Engineers, Automobile Mechanics, Manufacturers' Salesmen, and Diesel Mechanics.)

One of the better known specialties which may be grouped under mechanical engineering technology is that of *tool designer*. 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, dies, special fixtures, and other attachments used in machine operations. He may also make detailed drawings of these tools and fixtures or supervise others in making them. Besides developing new tools, designers frequently redesign tools to improve their efficiency.

Machine drafting, with some designing, is another major area of work often grouped under mechanical technology. The work of technicians who are draftsmen is described elsewhere in this chapter.

*Other Areas of Technology.* Many fields of work besides those described above offer opportunities for engineering and science technicians. Those in the field of *metallurgical technology*, for example, work with metallurgists and metallurgical engineers in processing metals, minerals, and ceramics, and converting these substances into finished products. Their jobs may include testing metals and alloys to determine their physical properties or developing new ways of treating and using metals and alloys. Technicians in the field of *mathematics* assist mathematicians, engineers, and scientists by doing computations involving the use of algebra, logarithms, trigonometric functions, and higher mathematics. Those working in the field of *biology* assist biological scientists in conducting tests and experiments to gain knowledge about living organisms and in applying this knowledge to the solution of practical problems, such as the development of new drugs and vaccines or new varieties of plants. In *agricultural technology*, technicians work with agricultural scientists in improving farm products, the quality of foods, and soil conditions. Still other fields

of work for technicians include cartography (mapmaking), electrical technology (power), gas turbine technology, optical technology, and petroleum technology.

As industry becomes increasingly mechanized, new technical occupations continue to emerge. For example, *instrumentation technology* has evolved from the introduction of 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, mixtures, volume, flow, strain, and pressure. Technicians in this field work with the engineers and scientists who develop and design these highly complex devices, as well as with those who use them for research and development work. (See also statement on Instrument Makers.)

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, in particular, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See chapter on Occupations in the Atomic Energy Field.)

### Where Employed

An estimated 675,000 engineering and science technicians, not including draftsmen and surveyors, were employed in early 1967—about 11 percent were women. Nearly 500,000 of these technicians (almost three-fourths of the total) were employed by private industry. The manufacturing industries employing the largest numbers of engineering and science technicians were electrical equipment, machinery, chemicals, and aerospace. In the nonmanufacturing sector, large numbers of technicians were employed in the communications indus-

try and by engineering and architectural firms.

In early 1967, the Federal Government employed approximately 75,000 engineering and science technicians; chiefly as engineering aids and technicians, electronic technicians, equipment specialists, cartographic aids, meteorological technicians, and physical science technicians. Of these engineering and science technicians, the largest number worked for the Department of Defense. Most of the others were employed by the Departments of Agriculture, Commerce, and the Interior.

State Government agencies employed over 50,000 engineering and science technicians in early 1967 and local governments almost 20,000. The remainder were employed by colleges and universities, mostly in university-operated research institutes, and by nonprofit organizations.

### Training, Other Qualifications, and Advancement

Young men and women who wish to prepare for careers as engineering or science technicians can obtain the necessary training from a great variety of educational institutions or can qualify for their work right on the job. Most employers, however, seek workers who have had some form of specialized training for more responsible technician jobs. Specialized formal training programs are offered in post-secondary schools—technical institutes, junior and community colleges, area vocational technical schools, and extension divisions of colleges and universities—as well as in technical and technical-vocational high schools. Other ways in which persons can become qualified for technician jobs are by completing an on-the-job training program, through work experience and formal courses taken on a part-time basis in post-secondary or correspondence schools, or through training and experience obtained while serving in the Armed Forces. In addition, many engineering and science students who have not

completed all the requirements for a bachelor's degree, as well as some other persons with college education in mathematics and science, are able to qualify for technician jobs after they obtain some additional technical training and experience. In general, post-secondary school technical training is required for a growing number of engineering and science technician jobs.

Engineering and science technicians usually begin work as trainees or in the more routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they are given more responsibility, often carrying out a particular assignment under only general supervision. Technicians may move into supervisory positions. Those with exceptional ability sometimes obtain additional formal training and are promoted to professional engineering positions.

For admittance to most schools offering post-secondary technician training, a high school diploma is usually required. Some schools, however, admit students without a high school diploma if they are able to pass special examinations and otherwise demonstrate their ability to perform work above the high school level. All engineering and science occupations require basic training in mathematics and science, thus students should obtain a sound background in these subjects while in high school. Many post-secondary schools have arrangements for helping students make up deficiencies in these subjects.

Programs offered by schools specializing in post-high school technical training require 1, 2, or 3 years of full-time study. The majority are 2-year programs, leading to either an associate of arts or science degree. Evening as well as day sessions are generally available. The courses offered in science, mathematics, and engineering are usually at the college level. They include instruction in laboratory techniques and the use of instruments, and emphasize the practical problems met on the job. Students are also instructed in the use of ma-

chinery and tools, but more to give them a familiarity with such equipment than to develop skills.

Because of the variety of educational institutions offering training and the differences in the kind and level of training, persons seeking a technical education should use more than ordinary care in selecting a school. Information should be secured about the fields of technology in which training is offered, accreditation, the length of time the school has been in operation, instructional facilities, faculty qualifications, acceptability of credits toward the bachelor's degree, and the type of work obtained by the school's graduates.

Briefly discussed here are some of the types of post-secondary educational institutions and other sources where young people can obtain training as technicians.

*Technical Institutes.* Technical institutes offer training designed to qualify the graduate for a specific job or cluster of jobs immediately upon graduation, and with a minimum of on-the-job training. In general, the student receives intensive technical training but less theoretical and general education than is provided in curriculums leading to a bachelor's degree in engineering and liberal arts colleges. A few technical institutes and community colleges offer cooperative programs in which a student spends part of his time in school and part in paid employment related to the occupation for which he is preparing himself.

Some technical institutes are operated as regular or extension divisions of colleges and universities. Others are separate institutions operated by States or municipalities, privately endowed institutions, and proprietary schools.

*Junior Colleges and Community Colleges.* Many junior and community colleges offer the necessary training to prepare students for technician occupations. Some of these schools offer curriculums that are equivalent to those given in the freshman and sophomore years of 4-year colleges. Graduates can transfer to

the junior year in a 4-year college or qualify for technician jobs. Most large community colleges offer 2-year technical programs, and many employers express a preference for graduates with this more specialized training. Generally, these students can transfer to the sophomore year in a 4-year college. Junior college courses in technical fields are often planned around the employment needs of the industries in their locality.

*Area Vocational-Technical Schools.* Area vocational-technical schools are post-secondary public institutions that are established in central locations to serve students from several surrounding areas. In general, the admission requirements of vocational-technical schools are as rigid as those of other schools offering post-secondary technician training. Area school curriculums are usually designed to train the types of technicians most needed in the area.

*Other Training.* Some large corporations conduct training programs to meet their need for technically trained personnel. This type of training is primarily technical and rarely includes any general studies.

Training for some occupations in the technician category—tool designer and electronic technician, for example—may be obtained through a formal apprenticeship.

Correspondence schools provide technician training for those who wish to learn more about their jobs.

Technician training is offered by all branches of the Armed Forces. Many of the technicians trained by the military utilize their training in civilian employment, especially in the field of electronics, after they leave the Armed Forces.

## Employment Outlook

Employment opportunities for engineering and science technicians are expected to be very good through the 1970's. In general, the demand will be strongest for graduates of post-secondary school training programs

to fill the more responsible engineering and science technician jobs.

Among the factors underlying the increase in demand for technicians are the anticipated expansion of industry and the increasing complexity of modern technology. As products and the methods by which they are manufactured become more complex, increasing numbers of technicians will probably be required to assist engineers in such activities as production planning, maintaining liaison between production and engineering departments, and technical sales work. Furthermore, as the employment of scientists and engineers continues to grow, increasing numbers of technicians will be needed to assist them. The trend toward automation of industrial processes and the growth of new areas of work, such as that related to space exploration or atomic energy, will probably also add to the demand for technical personnel. In addition to the technicians needed to fill new positions, an average of about 35,000 will be needed each year through the 1970's to replace those who retire, die, or transfer to other occupations.

Another factor supporting the expected increase in demand for engineering and science technicians is the growth anticipated in research and development expenditures. Such expenditures have increased rapidly in recent years and are expected to continue to rise through the 1970's although somewhat more slowly than in the past. Expenditures for the defense and space programs also affect the demand for technical personnel because a large number are engaged in activities related to the defense and space programs. The above outlook for technicians is based on the assumption that defense and space activities in the late 1970's will not be significantly different from the levels of the early and mid-1960's, prior to the Vietnam buildup.

Well-qualified women technicians should continue to find favorable employment opportunities, chiefly in designing jobs, in chemical and other laboratory work, and in computation

and other work requiring the application of mathematics. Over the longrun, it is likely that more women will be trained and will find employment in these and other technician occupations.

### Earnings

In general, a technician's earnings depend upon his education and technical specialty, as well as his ability and work experience. Other important factors which influence his earnings are the type of firm for which he works, his specific duties, and the geographic location of his job.

Annual starting salaries for graduates of post-secondary technical schools averaged about \$6,000 in private industry in 1966. Young persons entering engineering and science technician jobs with less formal training generally earned somewhat less.

In Federal Government agencies in early 1967, beginning engineering and science technicians were offered \$4,269, \$4,776 or \$5,331, depending upon the type of job vacancy and the applicant's education and other qualifications. Some Federal Government agencies hire high school graduates and train them for technician jobs. Beginning salaries for these jobs are \$3,925 a year.

Most technicians can look forward to an increase in earnings as they move to higher positions. In 1966, annual salaries of workers in responsible technician positions in private industry averaged almost \$9,000, and approximately one-fourth of the workers had annual salaries above \$9,600 according to a Bureau of Labor Statistics survey.

### Where To Go for More Information

General information on careers for engineering and science technicians may be obtained from:

American Society for Engineering Education,  
Technical Institute Council, Dupont Circle Building,  
1346 Connecticut Ave. NW., Washington, D.C. 20036.

Engineers' Council for Professional Development,  
345 East 47th St., New York, N.Y. 10017.

National Council of Technical Schools,  
1507 M St. NW., Washington, D.C. 20005.

Information on training opportunities may also be obtained from the Engineers' Council for Professional Development, a nationally recognized accrediting agency for engineering technology programs; the National Council of Technical Schools; and the U.S. Department of Health, Education, and Welfare, Office of Education, Division of Higher Education and/or Division of Vocational and Technical Education, Washington, D.C. 20202.

State departments of education at each State capital also have information about approved technical institutes, junior colleges, and other educational institutions within the State offering post-high school training for specific technical occupations. Other sources include:

American Association of Junior Colleges,  
1315 16th St. NW., Washington, D.C. 20036.

National Home Study Council,  
1601 18th St. NW., Washington, D.C. 20009.

### DRAFTSMEN

(D.O.T. 001. through 019.)

### Nature of Work

In making a space capsule or an electric iron, a nuclear submarine or a television set, a bridge or a typewriter, detailed plans are needed that give the exact dimensions and specifications for the entire object and each of its parts. The workers who draw these plans are draftsmen.

Draftsmen translate the ideas, rough sketches, specifications, and calculations of engineers, architects, and designers into working plans which are used in making a product.



Draftsman prepares detailed drawing.

Draftsmen may calculate the strength, reliability, and cost of materials. In their drawings and specifications, they describe exactly what materials and processes workers are to use on a particular job. To prepare their drawings, draftsmen use such instruments as compasses, dividers, protractors, and triangles, as well as machines that combine the functions of several devices. They may also use engineering handbooks and tables to assist in solving technical problems.

Draftsmen are often classified according to the type of work they do or their level of responsibility. *Senior draftsmen* use the preliminary information provided by engineers and architects to prepare design "layouts" (drawings made to scale of the object to be built). *Detailers* make drawings of each part shown on the layout, giving dimensions, material, and

any other information necessary to make the detailed drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or in recording dimensions and specifications. Under the supervision of draftsmen, *tracers* make minor corrections and prepare drawings for reproduction by tracing them on transparent cloth, paper, or plastic film.

Draftsmen may also specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, and architectural drafting.

#### Where Employed

An estimated 270,000 draftsmen were employed in early 1967; almost 4 percent were women. The large majority of draftsmen about 9 out of

10—are employed in private industry. The manufacturing industries that employ large numbers of draftsmen are the machinery, electrical equipment, fabricated metal products, and transportation equipment industries. Nonmanufacturing industries employing large numbers of draftsmen are engineering and architectural consulting firms, construction companies, and public utilities.

About 29,000 draftsmen worked for Federal, State, and local governments in early 1967. Of those employed by the Federal Government, the large majority work for the Departments of the Army, Navy, and Air Force. Draftsmen employed by State and local governments work chiefly for highway and public works departments. A few thousand draftsmen are employed by colleges and universities and by nonprofit organizations.

#### Training, Other Qualifications, and Advancement

Young persons interested in becoming draftsmen can acquire the necessary training from a number of sources, including technical institutes, junior and community colleges, extension divisions of universities, vocational and technical high schools, and correspondence schools. Other persons may qualify for draftsmen jobs through on-the-job training programs combined with part-time schooling or through 3- or 4-year apprenticeship programs.

The prospective draftsman's training, whether obtained in high school or post-high school drafting programs, should include courses in mathematics and physical sciences, as well as in mechanical drawing and drafting. The study of shop practices and the learning of some shop skills are also helpful, since many higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, strength of materials, and physical metallurgy.

Young people with only high school drafting training usually start out as tracers. Those with some formal post-high school technical training can often qualify as junior draftsmen. As draftsmen gain skill and experience, they may advance to higher level positions as checkers, detailers, senior draftsmen, or supervisors of other draftsmen. Some may become independent designers. Furthermore, some draftsmen who take courses in engineering and mathematics are able to transfer to engineering positions.

Qualifications for success as a draftsman include the ability to visualize objects in three dimensions and to do freehand drawing. Although artistic ability is not generally required, it may be very helpful in some specialized fields.

### Employment Outlook

Employment opportunities for draftsmen are expected to be favorable through the 1970's. Prospects will be best for those with post-high school drafting training. Well-qualified high school graduates who have had only high school drafting, how-

ever, will also be in demand for some types of jobs.

Employment of draftsmen is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. In addition, as growth of engineering and scientific occupations continues, more draftsmen will be needed as supporting personnel. On the other hand, photoreproduction of drawings and expanding use of electronic drafting equipment are eliminating some routine tasks done by draftsmen and will probably bring about a reduction in the need for some less skilled 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 of work. The number needed to fill such vacancies, estimated to be about 10,000 in 1966, will probably rise slowly through the 1970's.

### Earnings

In private industry, persons in beginning drafting positions earned an average of about \$370 a month in early 1966, according to a Bureau of Labor Statistics survey. As they gain

experience, draftsmen may move up to higher level positions with a substantial increase in earnings. For example, the earnings of senior draftsmen averaged about \$580 a month in early 1966.

In the Federal Civil Service in early 1967, the entrance salary for high school graduates without work experience who were employed in trainee-draftsman positions was about \$325 a month. For those with post-high school education or with some experience in drafting, entrance salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between \$490 and \$580 in early 1967.

### Where To Go for More Information

American Institute for Design and Drafting,  
770 South Adams Road, Suite 110,  
Birmingham, Mich. 48011.

American Federation of Technical Engineers,  
900 F St. NW., Washington, D.C.  
20004.

See also section on Where To Go for More Information in the statement on Engineering and Science Technicians.

tisements, sell subscriptions, and perform general office work.

### Where Employed

An estimated 35,000 newspaper reporters were employed in the United States in 1967. The majority worked for daily newspapers; most of the others worked for weekly papers. In addition, some reporters were employed by press services and newspaper syndicates.

Reporters work in cities and towns of all sizes throughout the country. Of the more than 1,800 daily and 8,900 weekly newspapers, the great majority are in medium-size towns. Large numbers of reporters, however, are in cities, since big city dailies employ many reporters, whereas a small-town paper generally employs only a few.

### Training, Other Qualifications, and Advancement

Although talented writers with little or no academic training beyond high school sometimes become re-

porters, an increasing number of newspapers will consider only applicants with a college education; graduate work is also becoming increasingly important. Some editors prefer those with a degree in journalism; others consider a degree in liberal arts as equally desirable.

Professional training leading to a bachelor's degree in journalism can be obtained in more than 175 colleges; about 100 of these have separate departments or schools of journalism. The typical undergraduate journalism curriculum is offered during the junior and senior years of college, and is divided about equally 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. Although a number of schools award the master's degree in journalism, at present only a few offer programs leading to the doctor's degree in this field.

Young people who wish to prepare for newspaper work through a liberal arts curriculum should take English

## WRITING OCCUPATIONS

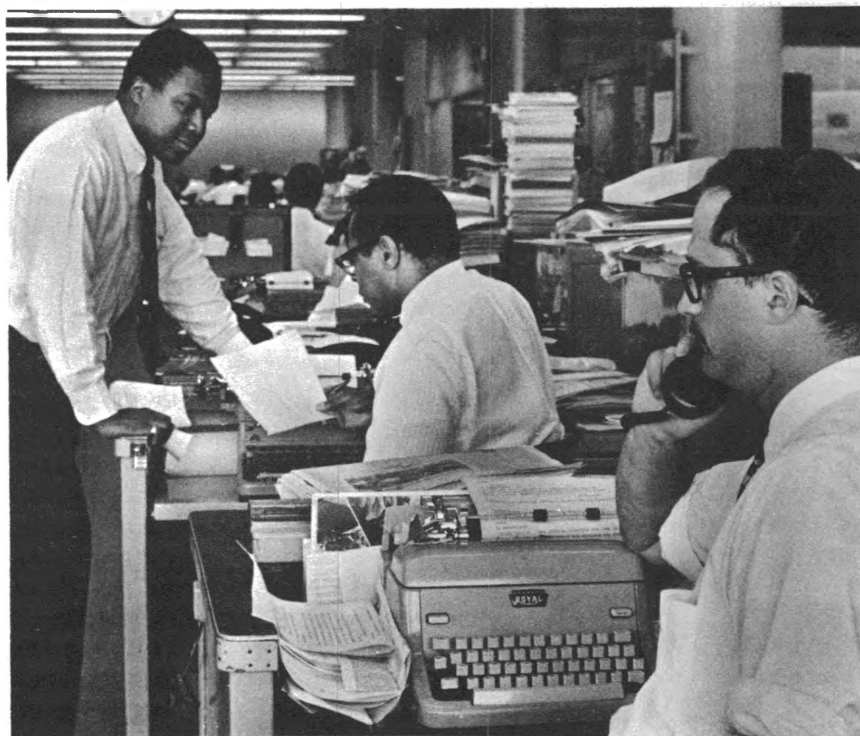
### NEWSPAPER REPORTERS

(D.O.T. 132.268)

#### Nature of Work

Newspaper reporters gather information on current events and write stories on many subjects for publication in daily or weekly newspapers. In covering these events, they may interview people, review public records, attend news happenings, and do research. As a rule, reporters take brief notes while collecting the facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their stories to "dictationists" or give the information by phone to other staff members known as "rewrite men," who write the stories for them.

Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to cover news originating in these places, whereas other local news is handled by general assignment reporters. Specialized reporters, who are well-versed in a subject matter field as well as in writing, are increasingly interpreting and analyzing the news in fields such as medicine, politics, science, education, business, labor, and religion. Reporters on small newspapers get broad experience; they 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 adver-



courses that include writing, as well as such subjects as sociology, political science, economics, history, and psychology. Reading and conversational ability in a foreign language and some familiarity with mathematics also are desirable qualifications. Those who look forward to becoming technical writers, or to reporting in a special field such as science, should concentrate on course work in their subject matter areas to the maximum extent possible. (See statement on Technical Writers.) Those without college training usually qualify by gaining experience on rural, small-town, or suburban papers.

Personal characteristics of importance are a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life. Skill in typing is useful since reporters often type their own news stories. On small papers, a knowledge of news photography is also valuable.

Many beginners start on weekly or small daily newspapers. Some outstanding college graduates are hired directly for reporting positions by papers that prefer to train them on the job. Others, also usually college graduates, start on large city papers as copy boys, acting as messengers or office boys. They may be promoted to reporting jobs as they gain experience and as openings arise. Opportunities are increasing for college students to learn the rudiments of reporting through summer internships with newspapers. These internships—well over 1,000 in 1966—usually lead to regular employment upon graduation.

In competing for regular positions, it is helpful to have had experience as a "stringer"—one who covers the news in a particular area of the community for a newspaper and is paid on the basis of the stories printed. Experience on a high school or college newspaper may also be helpful in obtaining employment.

Beginning reporters are first assigned to such work as summarizing

speeches, covering civic and club meetings, writing obituaries, interviewing visitors to the community, and covering police court proceedings and minor news events. As they gain experience, they may advance to covering more important developments, to an assigned "beat," or to specializing in a particular field of knowledge. Reporters with extensive experience may become rewrite men or copy editors. Newspapermen also progress to reporting jobs with larger papers or with press services and newspaper syndicates. Some experienced reporters advance to positions such as columnist, correspondent, or editor; to top executive positions; or become publishers; but these positions represent the top of the field and competition for them is keen. Other reporters transfer to related fields such as magazines, radio and television news, advertising, or public relations.

### Employment Outlook

Well-qualified beginners with exceptional writing talent will find good employment opportunities through the 1970's. In early 1967 editors of large newspapers were actively seeking young reporters with exceptional talent. Other beginners, however, were facing keen competition for jobs, especially on large city dailies, and will probably continue to do so. In addition to seeking young reporters with exceptional talent, editors were also looking for reporters who were qualified to handle news about highly specialized or technical subjects.

Weekly or daily newspapers located in small towns and suburban areas will continue to offer the most opportunities for beginners entering newspaper reporting. Openings arise on these papers as young people gain experience and transfer to reporting jobs on larger newspapers or to other types of work. Moreover, the number of newspapers in suburban areas is increasing, and many of the existing ones are expanding their staffs to satisfy the need for more detailed com-

munity news. Preference in employment on small papers is likely to be given to beginning reporters who are able to help with photography and other specialized aspects of newspaper work and who are acquainted with the community.

Large city dailies will provide some openings for the inexperienced with good educational backgrounds and a flair for writing to enter as reporter trainees; some opportunities may continue to be available for young people to enter as copy boys and advance to reporting jobs.

In addition to jobs in newspaper reporting, new college graduates with journalism training may enter 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 future. Factors pointing toward this 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. As newspapers share in this growth, employment of reporters is expected to increase moderately. The greatest number of job openings, more than a thousand each year, will continue to arise from the need to replace reporters who are promoted to editorial or other positions, transfer to other fields of work, retire, or leave the profession for other reasons.

### Earnings and Working Conditions

Many daily newspapers have negotiated, with the American Newspaper Guild, contracts which set minimum wages based on experience and provide for annual salary increases. In late 1966, the minimum starting salaries on most daily newspapers with Guild contracts ranged between \$80 and \$120 a week for reporters with no previous experience. On a few small dailies, the Guild minimum starting salaries were less than \$70 a

week; on a few large dailies, Guild minimum rates for beginning reporters exceeded \$130 a week. Young people working as copy boys earn less than new reporters; minimum Guild rates for copy boys with some experience ranged from about \$50 to slightly more than \$90 a week.

On most dailies, minimum Guild rates for reporters with some experience (usually for those with 4 to 6 years) ranged from about \$140 to \$180 a week in late 1966. Contract minimums for experienced reporters on a few small dailies were less than \$130 a week; on a few large dailies they were about \$200 a week. Papers under Guild contracts often pay salaries higher than the minimum rates called for in their contracts. Particularly successful, experienced reporters on city dailies may earn over \$300 a week.

Newspaper reporters on big city papers frequently work 7 to 7½ hours a day, 5 days a week; most other reporters generally work an 8-hour day, 40-hour week. Many of those employed by morning papers start work in the afternoon and finish about midnight. City papers pay overtime rates for work performed after the regularly scheduled workday, or for more than 40 hours of work a week; they often provide various employee benefits such as paid vacations, group insurance, and pension plans.

### 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, N.Y.,  
10017.

Information on opportunities in the newspaper field as well as a list of scholarships, fellowships, assistantships, and loans available at colleges and universities, may be obtained from:

The Newspaper Fund, Inc.,  
Box 300, Princeton, N.J. 08540.

Sigma Delta Chi,  
35 East Wacker Dr., Chicago, Ill.  
60601.

Information on union wage rates is available from:

American Newspaper Guild, Research Department,  
1126 16th St. NW., Washington,  
D.C. 20036.

General information on journalism opportunities may be obtained from:

American Council on Education for Journalism,  
Ernie Pyle Hall,  
Bloomington, Ind. 47405.

Names and locations of daily newspapers and a list of departments and schools of journalism are published in the *Editor and Publisher International Yearbook*, available in most large newspaper offices and public libraries.

## TECHNICAL WRITERS

(D.O.T. 139.288)

### Nature of Work

The many technical and scientific developments of recent years have created a growing demand for writers skilled in interpreting these developments. The technical writer organizes, writes, and edits material about science and technology so that it is in a form most useful to those who need to use it—be it a technician or repairman, a scientist or engineer, an executive, or a housewife. When writing for the nonspecialist he must present his material in a simple, clear, and factual manner; for the specialist he must include technological detail, using a highly specialized vocabulary. Regardless of what kind of writing he does, the technical writer serves to establish easy communication between scientists, engineers, and other technical specialists, and the users of their information.

The technical writer's product takes many forms, such as a publicity release on a company's scientific or technical achievement or a manu-

facturer's contract proposal to the Federal Government. It may be a manual that explains how to operate, assemble, disassemble, maintain, or overhaul components of a missile system or a home appliance. Technical writers also write for scientific and engineering periodicals, and for popular magazines.

Technical writers as defined in this statement include only those people primarily employed to interpret, write about, or edit technical or scientific subject matter. It excludes those primarily employed as scientists, engineers, or other technical specialists who also do a considerable amount of writing.

Before starting a writing assignment, a technical writer must usually research his subject. This process involves studying reports, reading technical journals, and consulting with the engineers, scientists, and other technical personnel who have worked on the project. Then, he prepares a rough draft that may be revised several times before it is in final form. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork, and in so doing may work with technical illustrators, draftsmen, or photographers.

### Where Employed

About 30,000 technical writers and editors were employed in early 1967. Most technical writers are employed in the electronics and aerospace industries. Many work for research and development firms or for the Federal Government—mainly in the Departments of Defense and Agriculture, the Atomic Energy Commission, and the National Aeronautics and Space Administration. Some work in the more than 300 job shops that specialize in technical writing. Others are in business for themselves as freelance technical writers.

Technical writers are employed primarily in the Northeastern States, Texas, and California. They are concentrated in the Washington, D.C.,



Los Angeles, Houston, Fort Worth—Dallas, Chicago, New York, Boston, and Philadelphia metropolitan areas.

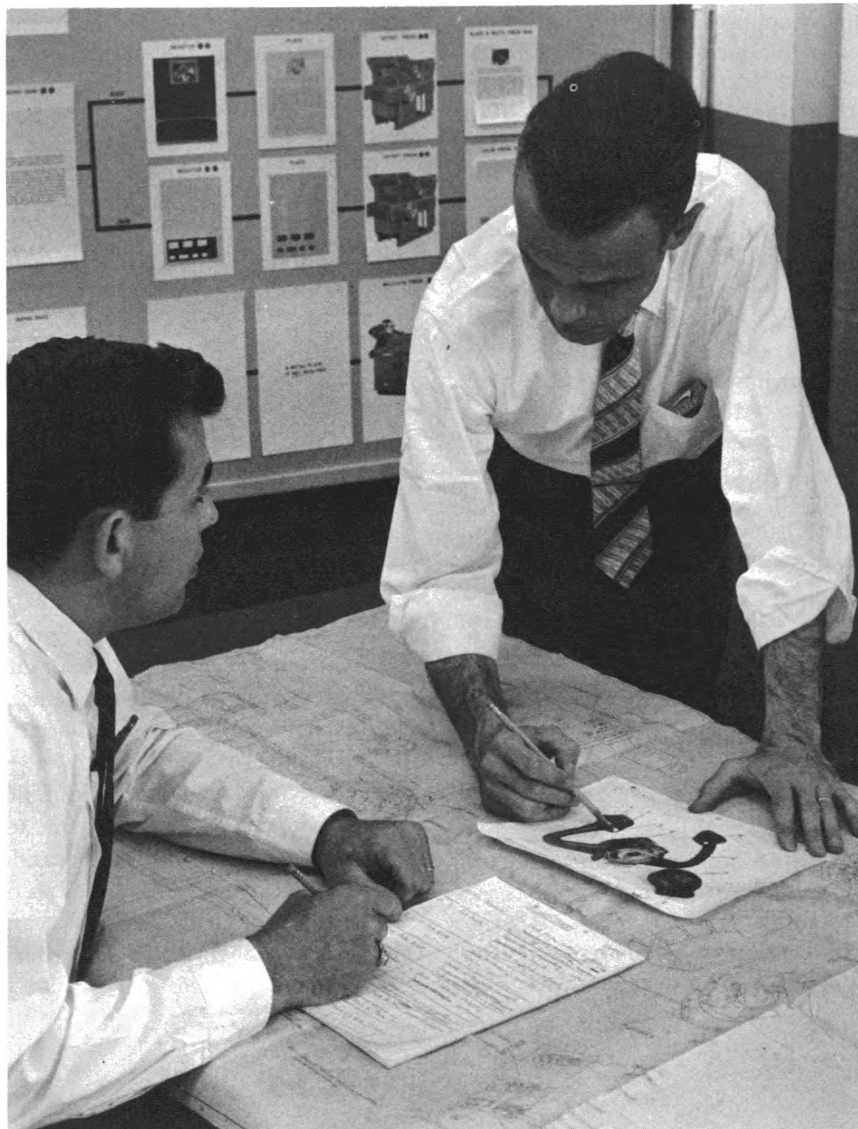
### Training, Other Qualifications, and Advancement

The bachelor's degree is the desirable minimum entrance requirement for work in this field, although talented and experienced writers having less academic training can qualify. Employers do not agree on the most appropriate kind of college training needed by technical writers, but graduates usually must have a combination of courses in writing and scientific and technical subjects. Some employers prefer applicants with degrees in engineering or science who have had courses in writing. Others seek graduates with majors in English or journalism who have taken some courses in scientific and technical subjects. Regardless of the college training they prefer, all employers place great emphasis on writing skills.

Few schools offer formal undergraduate programs leading to a bachelor's degree in technical writing or technical journalism. However, about 170 colleges and universities provide professional education leading to a bachelor's degree in journalism; and most of these offer at least one course in technical writing or technical journalism as part of the regular curriculum. Liberal arts colleges and some engineering schools offer English and other courses that sharpen writing skills. Many colleges and universities conduct short-term summer workshops and seminars for technical writers.

Young people who plan to become technical writers should, while still in high school, supplement the required science and mathematics courses with as many elective courses in grammar and composition as possible. They also can gain helpful experience by working as editors or writers for their school papers.

In addition to the ability to write well, technical writers must have the



Technical writer confers with engineer on product specifications.

ability to think logically. They should have a great interest in scientific and technological developments and be able to work and communicate well with others.

Beginners often assist experienced technical writers by doing library research, by editing, and by preparing drafts of portions of reports. Experienced writers in organizations with large technical writing staffs may become technical editors or progress to supervisory and administrative positions. After gaining experience and contacts, a few may open their own job shops.

It also is possible to advance by becoming a specialist in a particular scientific or technical subject. These writers sometimes prepare syndicated newspaper columns or articles for popular magazines.

### Employment Outlook

Well-qualified and experienced technical writers are expected to find excellent employment opportunities through the 1970's. Beginners who have good writing ability and appropriate education also should find

many opportunities; those with minimum qualifications will find stiff competition for jobs. The greatest demand probably will be for technical writers with backgrounds in electronics and communications, particularly in research and development, to work in the aerospace and related industries.

The employment of technical writers is expected to increase moderately throughout the late 1960's and during the 1970's because of the need to put the increasing volume of scientific and technical information into language that can be understood by management for decisionmaking and by technicians for operating and maintaining complicated industrial equipment. Also, since many products will continue to be assembled from components manufactured by different companies, technical writers will be in demand to describe, in simple terms, the interrelationships of these components. The growth in this occupation will be accelerated also by the need for improved and simplified operating and maintenance instructions for new consumer products.

The demand for technical writers will continue to be related to research and development expenditures. These

expenditures are expected to remain at high levels in the aerospace industry and to increase somewhat in medical and other fields.

Technical writers with training in journalism also will find opportunities in other fields that employ writers, such as advertising, public relations, trade publishing, radio, and television.

### **Earnings and Working Conditions**

In 1967, inexperienced technical writers with bachelor's degrees were hired in private industry at starting salaries ranging from \$5,000 to \$7,000 a year; those with moderate experience earned from \$7,000 to \$10,000 a year; highly experienced writers earned from \$11,000 to \$15,000, and those in supervisory and management positions up to \$20,000. Differences in the earnings of experienced writers depended not only on their ability and prior experience, but also on factors such as the type, size, and location of their employing firms. Earnings of freelance technical writers vary greatly and are related to the writer's reputation in the field.

In the Federal Government in early 1967, inexperienced technical writers with a bachelor's degree and credit for about five science courses could start at either \$5,331 or \$6,451 a year, depending on their college records. Those with 2 years' experience could begin at \$7,696. With 3 years' experience, they could start at \$9,221 or \$10,927 a year, depending on the caliber of the experience.

Technical writers usually work the standard 40-hour week. They may work under considerable pressure, frequently working overtime when a deadline has to be met on a publication or report.

### **Where To Go for More Information**

Additional information on this occupation, including a list of schools offering accepted courses of study and specific training programs in accredited colleges and universities, may be obtained from:

Executive Secretary,  
Society of Technical Writers and  
Publishers, Inc.,  
Suite 421, 1010 Vermont Ave., Wash-  
ington, D.C. 20005.

## OTHER PROFESSIONAL AND RELATED OCCUPATIONS

### ARCHITECTS

(D.O.T. 001.081)

#### Nature of Work

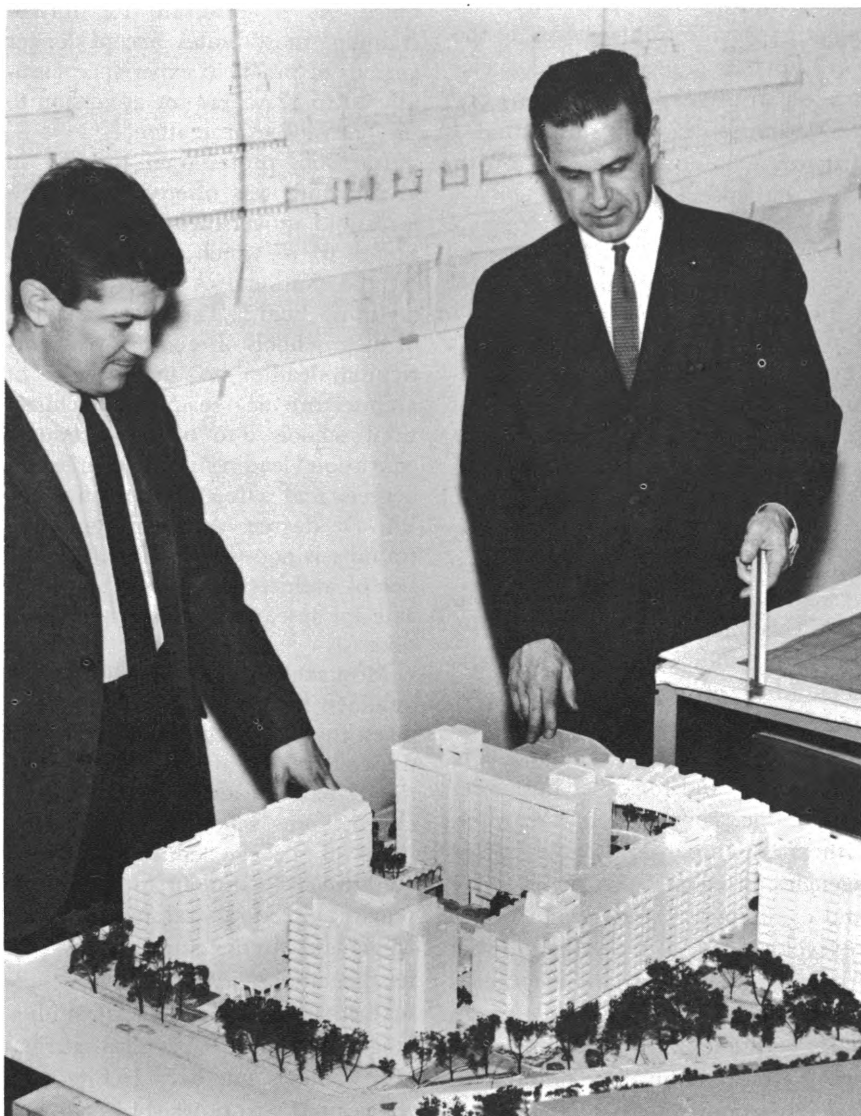
Architects plan and design buildings and other structures. Their goal is to design structures which are safe, useful, and pleasing in appearance. Architects also work with other professionals, such as engineers, urban planners, and landscape architects in the designing of cities and towns and in the planning and improvement of an overall physical environment.

When an architect receives a commission for a building, he meets with the client to discuss the purpose, requirements, and cost limitations of the structure as well as the client's preferences as to style and plan. Subsequently, the architect must make hundreds of decisions taking into account not only the requirements of the building, but also local and State building codes, zoning laws, fire regulations, and other ordinances. For example, in planning a school, the architect must decide, among other things, the amount of corridor and staircase space required to enable students to move easily from one class to another; the type and arrangement of storage space; and the location, size, and interior arrangements of the classrooms, laboratories, lunchroom, gymnasium, and administrative offices.

The architect makes preliminary drawings of the structure and meets with the client to develop a final design. This design includes floor plans as well as details of the interior and 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 the location of the plumbing, heating, electrical, air-conditioning, and other equipment. Consulting engineers usually prepare detailed drawings of the structural, plumbing, heating, and electrical work. Engineers' drawings are coordinated with the architect's working drawings, and

specifications are prepared listing the construction materials to be used, the equipment, and, in some cases, the furnishings.

The architect then assists his client in selecting a building contractor and in drawing up the contract between client and contractor, and he acts as the client's advisor and representative in dealings with the contractor. As construction proceeds, the architect makes periodic visits to the construction site to make certain that the design is being followed and that the materials specified in the contract are used. The architect's work is not completed until the project is fin-



Architects examine scale model of new project.

ished, all required tests are made, and guarantees are received from the contractor.

Most self-employed architects plan and design a wide variety of structures, ranging from homes to churches, hospitals, office buildings, and airports. Architects also plan and design multibuilding complexes for urban renewal projects, college campuses, industrial parks, and new towns. Some architects, however, specialize in one particular type of structure or project. When working on large-scale projects or for large architectural firms, architects frequently specialize in one phase of the work, such as design, drafting, specification writing, or construction contract administration (insuring that a structure is built in accordance with plans and specifications).

### Where Employed

An estimated 32,000 registered (licensed) architects were employed in the United States in early 1967. In addition, many other architectural school graduates who are unlicensed were working in positions requiring a knowledge of architecture. Less than 3 percent of all architects are women.

Approximately two-fifths of all architects are self-employed, either practicing individually or as partners. Most of the others work for architectural firms. Some architects work for engineers, builders, real estate firms, and for other businesses with large construction programs. Others are employed by government agencies, often in fields such as city and community planning and urban redevelopment. A few are full-time teachers in schools of architecture.

Architects are employed in all parts of the country. However, they are concentrated in those States with large metropolitan areas. Nearly half of the total are employed in six States—California, New York, Illinois, Texas, Pennsylvania, and Ohio.

### Training, Other Qualifications, and Advancement

A license for the practice of architecture is required by law in all States and the District of Columbia, mainly to insure that architectural work which may affect the safety of life, health, or property is done by qualified architects. Requirements for admission to the licensing examination are set by the individual States. These generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office. As a substitute for formal training, most States accept longer periods of practical experience (usually 10 to 12 years) for admission to the licensing examination.

In 1966, professional training in architecture was offered by 78 colleges and universities in the United States, 61 of which were accredited by the National Architectural Accrediting Board. The great majority of these schools offered a 5-year curriculum leading to the bachelor of architecture degree. Many architectural schools also offered graduate education leading to the master's degree, and a few schools offer the Ph. D. degree. Although graduate training is not essential for the practice of architecture, it is often desirable for research and teaching positions.

Most schools of architecture admit qualified high school graduates who meet the entrance requirements of the college or university with which the school of architecture is associated. Some schools require 1 or 2 years of college education before admitting the student to a 3- or 4-year architectural training program. In general, architectural schools prefer that students' preparation include mathematics, science, social studies, language, and art. A typical curriculum includes not only architectural courses but also other subjects—usually English, mathematics, physics, chemistry, sociology, economics, and a foreign language.

Among the personal qualifications needed by persons planning a career in architecture are a capacity to master technical problems, a gift for artistic creation, and a flair for business and for human relations. Students are frequently encouraged to work for architects or for building contractors during summer vacations to gain some knowledge of practical problems.

New graduates usually begin as junior draftsmen in architectural firms where they make drawings and models of building projects or draft details in the working drawings. As they gain experience, they are given more complex work. After several years, they may progress to chief or senior draftsman, with responsibility for all the major details of a set of working drawings and for the supervision of other draftsmen. Other architects may work as designers, construction contract administrators, or specification writers. An employee who is particularly valued by his firm may be designated an associate and may receive, in addition to his salary, a share of the profits. Usually, however, the architect's goal is to establish his own practice.

### Employment Outlook

The outlook is for continued rapid growth of the profession through the 1970's. Employment opportunities are expected to be good both for experienced architects and for new architecture graduates.

A major factor contributing to this favorable outlook is the expected growth in the volume of nonresidential construction—the major area of work for architects. Moreover, the increasing size and complexity of modern nonresidential buildings, as well as homeowners' growing awareness of the value of architects' services, are likely to bring about a greater demand for architectural services. Urban redevelopment and city and community planning projects, other growing areas of employment for architects, are also expected to in-

crease considerably in the years ahead. (See statement on Urban Planners.) In addition, expanding college enrollments will create a need for additional architects to teach architectural courses.

Besides those needed to fill new positions due to growth, additional numbers of architects will be required each year to replace those who transfer to other fields of work, retire, or die. The number needed to fill such vacancies, estimated to be about 700 in 1966, will probably rise slowly in the future.

Along with the anticipated rise in demand for architects, an increase is expected in the number of architectural graduates. If graduations in this field follow the trend expected in all college graduations, the number of architectural degrees awarded each year during the late 1960's and the 1970's should be considerably greater than the 2,300 degrees awarded in 1965. However, many architectural graduates utilize their training in fields such as sales and administration in the building industry and do not enter the profession. Thus, those who choose to enter the field should have good employment opportunities through the 1970's.

The outlook for women architects, although less favorable than for men, is nonetheless expected to be good. However, few women establish themselves in private practice.

### Earnings and Working Conditions

Starting salaries for architectural school graduates were generally between \$100 and \$150 a week in 1966, according to available information. Draftsmen with 3 years or more experience earned between \$135 and \$180 a week; job captains, specification writers, and other senior employees usually earned from \$150 to \$250 a week. Senior employees often receive yearly bonuses in addition to their salaries.

After architects have become well established in private practice, they generally earn much more than high-

paid salaried employees of architectural firms. The range in their incomes is very wide, however. Some architects with many years of experience and good reputations earn well over \$25,000 a year. Young architects starting their own practices may go through a period when their expenses are greater than their income.

Most architects work in well-lighted, well-equipped offices and spend long hours at the drawing board. However, their routine is often varied by interviewing clients or contractors or discussing the design, construction procedures, or building materials of a project with other architects or engineers. Architects involved in construction contract administration frequently work out of doors during inspections at construction sites.

### Where To Go for More Information

The American Institute of Architects,  
1735 New York Ave. NW., Wash-  
ington, D.C. 20006.

Society of American Registered Archi-  
tects,  
1821 Jefferson Place NW., Wash-  
ington, D.C. 20036.

### COLLEGE PLACEMENT OFFICERS

(D.O.T. 166.268)

#### Nature of Work

College placement officers provide job placement services to students and graduates. They furnish information on full-time, part-time, and summer job openings; help students evaluate their special abilities and employment opportunities; and arrange for job interviews.

College placement officers interview students and analyze their education and work records in order to match qualifications to job requirements. They also may administer or arrange for vocational and psychological tests.



College placement officer and student discuss employment offers.

College placement officers arrange for employer representatives to visit the campus to discuss their firms' personnel needs and to interview qualified applicants. Placement officers may provide information about students to employer representatives and assist them in appraising the qualifications of students. They also may make new contacts with employers to develop additional employment opportunities. In addition, they may suggest improvements in employer recruitment literature and inform the college faculty of any change in job requirements that might warrant adjustment in curriculum.

Many college placement officers assemble and maintain a library of career guidance information from public and private sources and company recruitment literature for the use of students and alumni. Such material includes information on the nature of various occupations, together with data on current opportunities, educational requirements, earnings, advancement, and the long-term outlook.

Placement officers may specialize in such areas as law, teaching, part-time and summer work, or other specific group placements. However, the

extent of specialization usually depends upon the size and type of the college, as well as the size of the placement staff.

### Where Employed

Placement services are offered in nearly all colleges and universities. Large colleges may employ several placement officers working under a director of placement activities; in many institutions, however, a combination of placement functions is performed by one officer and his clerical staff. In some colleges, especially the smaller ones, the functions of placement officers may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement offices for each major branch or campus. In some universities, there is a central office which coordinates the work of all placement officers; in others, each office works as a separate unit.

An estimated 2,500 placement officers were employed in 4-year colleges and universities in 1967, most of them on a full-time basis. Of this total number, about one-third were women. In addition, an increasing number of placement officers were being employed full time or part time in 2-year colleges.

College placement officers are located in all parts of the country, although they are concentrated in the metropolitan areas where many colleges and universities are situated.

### Training, Other Qualifications, and Advancement

A bachelor's degree generally is considered the minimum requirement for entry into the field. Important undergraduate courses for the prospective placement officer include psychology, sociology, education, counseling, and personnel administration or related business subjects. At present, however, no specific educational specialty exists for college placement officers.

In 1967, more than 100 colleges and universities offered programs leading to a graduate degree in college student personnel work. These programs included such placement oriented subjects as vocational development theory, techniques of interviewing, career counseling, occupational and educational information, group dynamics, and college student personnel administration.

Many people enter college placement after working in other areas. A broad background of business or industrial experience, teaching experience, previous placement training, experience in public or private employment agencies, or knowledge of personnel and guidance techniques are all useful backgrounds for college placement work. In some instances, an alumnus who has displayed a strong interest in his school, and exhibits ability in working effectively with people, will be employed as an assistant in the placement office and may advance to more responsible positions as he gains experience.

A person who would like to enter the college placement field should have an interest in people, as well as the ability to gain the confidence of students, faculty, and employers. The ability to develop a keen insight into the employment problems of both employers and students and to maintain honest and confidential communications also is important in college placement work.

Advancement for college placement officers usually is through promotion to placement director, director of student personnel services, or to some other higher level administrative position. However, the extent of such opportunity usually depends upon the type of college or university and the size of the staff.

### Employment Outlook

The number of job opportunities in the college placement field is expected to rise very rapidly through the 1970's. In general, employment

prospects will be best for new or recent college graduates seeking beginning positions, particularly at their own alma maters. Among the factors expected to contribute to the favorable outlook for college placement officers are the increasing number of college graduates, and the expansion in the number of college students from lower income families who will seek part-time jobs during their college years to help finance their education. Demand for college placement officers will be increased also as a result of the trend among colleges and universities toward more emphasis on the student personnel service aspect of higher education. This emphasis has already resulted in increased placement activity for graduate students and alumni, and for undergraduates seeking summer and part-time employment. The increasing number of junior colleges and technical schools—the fastest growing segment of higher education—also will increase the demand for placement personnel.

The recent trend toward increased budget allocations for placement activities is expected to continue, thus leading to a growing demand for college placement officers in most parts of the country. In addition, regional college placement associations, through their coordinating organization, the College Placement Council, are expanding their programs to improve operations in existing placement offices of member colleges and to establish placement services where none presently exist.

Some openings also will occur each year as placement officers transfer to other positions, retire, or leave the field for other reasons.

### Earnings and Working Conditions

In 1966, annual earnings of placement office directors ranged from less than \$4,000 to a high of over \$20,000, with the average (median) salary about \$9,700, according to a National Education Association survey of 953 public and private colleges and uni-

versities. In general, the larger institutions paid the highest salaries. Earnings of placement officers and assistants averaged about two-thirds of the amount paid placement directors.

College placement officers usually work a standard 35- to 40-hour week; however, irregular hours and overtime usually are necessary during the "recruiting season." Most placement personnel are employed on a 12-month basis. They are paid for holidays and vacations, and receive the same benefits as other professional personnel employed by colleges and universities.

### Where To Go for More Information

The College Placement Council, Inc.,  
35 East Elizabeth Ave., Bethlehem,  
Pa. 18018.

## HOME ECONOMISTS

(D.O.T. 096.128)

### Nature of Work

Improving products, services, and practices that affect the comfort and well-being of the family is the primary aim of home economists. These professional workers must have a broad knowledge of the field or become specialists in a particular area such as food, clothing and textiles, housing, home equipment, child care, household management, or family economics.

Teachers make up the largest single group of home economists. Secondary school teachers give courses in food, nutrition, clothing, textiles, child care, family relations, home furnishings and equipment, household economics, and home management. The nature of much of the work done by home economics teachers is similar to that described in the statement on Secondary School Teachers, elsewhere in this *Handbook*. In addition, they may sponsor chapters of Future Homemakers of



Home economist gives food demonstration.

America, and conduct many related activities. Teachers in adult education programs help homemakers to increase their understanding of family relations, and to improve their homemaking methods and skills. College teachers may combine teaching and research, and often specialize in one particular area of home economics.

Private business firms and trade associations employ home economists to promote the development, use, and care of specific home products. They may do research and test products; prepare advertisements and booklets with instructional materials; plan, prepare, and present programs for radio and television; serve as consultants; give lectures and demonstrations before the public; and conduct classes for workers, salesmen, and appliance servicemen. They may also study consumer needs and help manufacturers translate these needs into useful products.

Home economists who work for food manufacturers do an important part of their work in test kitchens—improving present products or helping to create new products; they may also publicize the nutritional value of specific foods. Those employed by

utility companies often give advice on household problems, in addition to describing the operation and benefits of products and services. Home economists employed by manufacturers of kitchen and laundry equipment may work with engineers on product development. Those engaged in communications work for magazines, newspapers, radio and television stations, advertising and public relations agencies, trade associations, and other organizations. They usually prepare articles and advertisements to tell homemakers about home products and services. Their work may include product testing and analysis, work in research laboratories or test kitchens, and the study of consumer buying habits. Still other home economists work for dress-pattern companies, department stores, interior design studios, and other business firms that design, manufacture, and sell products for the home. A small number of home economists are employed in financial institutions, giving customers advice on spending, saving, and budgeting.

Some home economists are engaged in research work for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of these workers, some of whom study the buying and spending habits of farm families and then develop budget guides. A few in other Federal agencies are engaged in research on space travel, working on such problems as food needs in outer space.

Cooperative Extension Service home economists conduct adult education programs for women and 4-H Club programs for girls in such areas as home management, consumer education, family relations, and nutrition.

Home economists employed on social-welfare programs by State, county, city, and private welfare agencies may act as advisers and consultants on household budgets and improved homemaking. They may

help handicapped homemakers and their families adjust to physical limitations by changing the arrangements in the home and revising methods of work. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

### Where Employed

About 92,000 persons were employed in home economics occupations in 1966. This figure includes an estimated 30,000 dietitians and approximately 5,000 extension workers who are discussed in separate statements on Dietitians and Agricultural Extension Workers in the *Handbook*. More than 50,000 home economists were teachers. Approximately 33,000 were primarily secondary school teachers. About 14,000 were adult education instructors; however, a good many of these teachers taught both secondary school and adult education classes. In addition, there were about 2,500 college and university teachers. The remainder taught in elementary schools, kindergartens, nursery schools, recreation centers, and other institutions. More than 5,000 home economists were in private business firms and associations. Several hundred were primarily research workers, and a smaller group were advisers, consultants, and training supervisors in social welfare programs. A few were self-employed.

Although home economics is generally considered a woman's field, a growing number of men are employed in home economics positions. Most men specialize in foods and institution management, though some are in the family relations and child development field, applied arts, and other areas.

### Training, Other Qualifications, and Advancement

Approximately 450 colleges and universities offer training leading to

a bachelor's degree in home economics, which qualifies graduates for most entry positions in the field. A master's or doctor's degree is required for college teaching, for certain research and supervisory positions, for work as an extension specialist or supervisor, and for some jobs in the nutrition field.

The undergraduate curriculum in home economics gives students a strong background in science and liberal arts and also includes courses in each of the areas of home economics. Students majoring in home economics may specialize in various subject-matter areas. Advanced courses in chemistry and nutrition are important for those wishing to specialize in foods and nutrition; science and statistics for research work; and journalism for advertising, public relations work, and all other work in the communications field. To teach home economics in a high school, a student must complete the professional education courses and other requirements for a teacher's certificate in the State in which one wishes to teach.

Scholarships especially designated for undergraduates in the field are available, as well as scholarships, fellowships, and assistantships for graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association provide additional funds.

Home economists must be able to work with people of various living standards and backgrounds and should have a capacity for leadership, with ability to inspire cooperation. Good grooming, poise, and an interest in people are also essential, particularly when dealing with the public.

### Employment Outlook

Home economists are expected to have very good employment opportunities through the 1970's. The greatest demand will stem from the

need to fill teaching positions in secondary schools and in colleges and universities. Increased national focus on the needs of low-income families may also increase demand to work in welfare and extension service positions. In addition, the need for more home economists in research is expected to increase with the continued interest in improving home products and services. Many business establishments are also becoming increasingly aware of the contributions that can be made by professionally trained home economists and probably will hire more of them to promote home products and to act as consultants to customers.

Many home economists will be needed to replace those who die, retire, or leave the field because of family responsibilities or other reasons through the 1970's. Opportunities for those who leave the profession but who later wish to return will be good, especially as part-time teachers in adult education programs.

### Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers, as most school districts have a single-salary schedule, based on education and experience. In school districts of 100,000 pupils or more, the average (median) salary of beginning teachers who have a bachelor's degree was \$5,362 for the school year 1966-67, according to a National Education Association survey; in districts of 50,000 to 99,999 enrollment, starting salaries averaged \$5,268 and in districts of 25,000 to 49,999 enrollment, \$5,222.

The average (median) salary of home economics instructors teaching in colleges and universities was about \$6,800 a year in 1965-66. In the cooperative extension service, salaries of county extension home economists averaged about \$7,900 per year and those of State specialists, \$10,350 in late 1966.



The Federal Government paid inexperienced workers who have a bachelor's degree in home economics \$5,331 or \$6,451 in early 1967, depending on their scholastic records. For those having additional education and experience, salaries ranged from \$7,696 to \$15,106 a year, depending upon the type of position and level of responsibility.

Many home economists work a regular 40-hour week or less. Those in teaching and extension positions, however, frequently work longer hours as they are expected to be available for evening lectures, demonstrations, and other work falling outside the regularly scheduled hours. Most home economists receive fringe benefits such as paid vacation, sick leave, retirement pay, and insurance benefits.

### Where To Go for More Information

A list of schools granting degrees in home economics is available from the Home Economic Unit, Bureau of Adult and Vocational Education, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202.

Additional information about home economists and graduate scholarships may be obtained from:

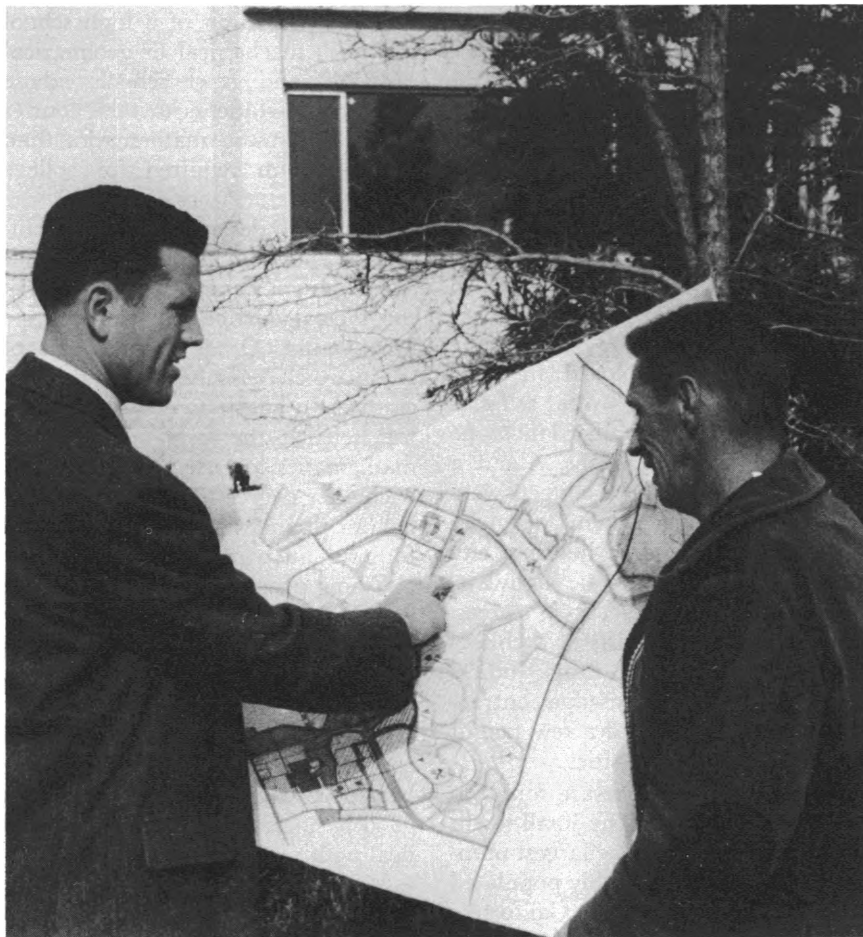
American Home Economics Association,  
1600 20th St. NW., Washington,  
D.C. 20009.

## LANDSCAPE ARCHITECTS

(D.O.T. 019.081)

### Nature of Work

Everyone enjoys walking through an attractively designed park or taking a drive along a scenic road. Landscape architects plan, design, and supervise the arrangement of such outdoor areas for people to use and enjoy. The attractiveness of parks, highways, housing projects, campuses, and country clubs reflects the skill of these architects in design-



Landscape architect discusses site plan with contractor.

ing landscapes that are useful and pleasing. Their knowledge of site planning allows landscape architects to serve many types of clients, from a real estate firm embarking on a new suburban development to a city preparing to build an airport.

Landscape architects may plan the entire arrangement of a site and supervise the grading, construction, and planting required to carry out the plan. Whether they perform all or only part of these services on a particular project, however, depends on the client's wishes and the available funds.

To plan a site, landscape architects first study the nature and purpose of the client's project, and the various types of structures needed. Next, they study the site itself, observing and mapping such features as the slope of

the land and the position of existing buildings and trees. They also consider the parts of the site that will be sunny or shaded at different times of the day, the structure of the soil, existing utilities, and many other factors. Then, after consultation with the architect and engineer working on the project, they draw up preliminary plans for the development of the site. After the client approves the preliminary plans, working drawings are made which show all existing and proposed features, such as buildings, roads, walks, terraces, grading, and drainage structures in planted areas. Landscape architects outline in detail the methods of constructing such features as walks and terraces and draw up lists of materials to be used. Landscape contractors are then invited to submit bids for the work.

Firms of landscape architects usually handle a wide variety of assignments. Some, however, specialize in such projects as parks and playgrounds, campuses, hotels and resorts, shopping centers, roads, or public housing.

### Where Employed

An estimated 5,000 landscape architects were employed in early 1967. The majority were self-employed or worked for other landscape architects in private firms. About a third of all landscape architects were employed by government agencies concerned with public housing, city planning, urban renewal, highways, and parks and recreational areas. Some were on the staffs of architectural or engineering firms; others were employed by landscape contractors and nurseries, and a few taught in colleges and universities.

Landscape architects are found in every State and in many small towns as well as big cities. The largest numbers are in the most highly populated States. New York and California, with large populations and high per capita incomes, have more landscape architects than other States.

### Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture is usually the minimum requirement for entering the profession. Such training is offered in at least 25 colleges and universities, of which 21 have been accredited by the American Society of Landscape Architects. The curriculum for the bachelor's degree requires 4 to 5 years of study, depending on the institution. Fifteen universities also offer master's degrees in landscape architecture.

Entrance requirements for the landscape architecture course are usually the same as those for admission to the liberal arts college of the same university. Some schools also

require completion of a high school course in mechanical or geometrical drawing, and most schools advise high school students to take courses in art and more mathematics than the minimum required for college entrance.

Courses in design, including architecture and drawing as well as landscape design, constitute over half of the typical curriculum in landscape architecture. Other major fields of study are civil engineering and horticulture. In addition, courses in English, science, the social sciences, and mathematics are usually required. A bachelor's degree in landscape architecture provides a good background for graduate work in city planning.

Young people who plan to become landscape architects should be interested in both art and nature, for the profession demands a talent for design and an understanding of plant life, as well as technical ability. Successful practice as an independent landscape architect also requires a good business sense and the ability to deal with people.

Working for landscape architects or landscape contractors during summer vacations will help the student to discover the phases of landscape architecture that interest him most and may better qualify him for employment upon graduation.

New graduates usually begin as junior draftsmen, tracing drawings and doing other simple drafting work. As their skill increases, they progress to more responsible work. After 2 or 3 years, they can usually advance to senior draftsmen, qualified to carry a design through all stages, from preliminary sketches to finished working drawings. Experienced draftsmen often handle other aspects of landscape architects' work also, such as preparing specifications and detailing methods of construction. Employees who demonstrate ability for all phases of work may become associates of the firm; landscape architects who progress this far often open their own offices.

A license is required for the independent practice of landscape archi-

tecture in 10 States—California, New York, Michigan, Nebraska, Georgia, Oregon, Louisiana, Florida, Pennsylvania, and Ohio. Candidates for the licensing examination are usually required to have 6 to 8 years' experience, or a degree from an accredited school of landscape architecture plus 2 to 4 years' experience.

### Employment Outlook

Employment opportunities for graduates with professional training in landscape architecture are expected to be favorable throughout the 1970's. The profession will probably continue to expand in the years ahead as a result of the continued growth of metropolitan areas with their needs for parks and recreational areas, the growing population's requirements for outdoor recreational facilities, the continued increase in public construction (including public housing), and the rising interest in city and regional planning. The expected increase in homeownership, coupled with rising per capita incomes and living standards, will also spur the demand for landscape architects.

Women represent between 5 and 10 percent of all landscape architects. Well-trained and competent women landscape architects can look forward to interesting and worthwhile careers in the profession, particularly as specialists in garden and planting design.

### Earnings and Working Conditions

In early 1967, starting salaries in private offices for new graduates in landscape architecture ranged from about \$80 to \$140 a week, with the average about \$115. The relatively higher salaries generally were paid to graduates who had gained experience in summer jobs in landscape architecture firms. Experienced persons employed by private firms typically earned from about \$8,000 to \$11,000 a year, although it was not unusual

for especially well-qualified people to receive annual salaries of \$14,000 or more.

Landscape architects in independent practice often earn more than salaried employees with considerable experience, but their earnings vary widely and may fluctuate from year to year. In recent years, earnings for this segment of the profession have ranged from about \$7,500 to \$15,000 a year, with some people of exceptional ability and established reputation earning \$25,000 a year or more.

In the Federal Civil Service in early 1967, newly graduated landscape architects were paid annual entrance salaries of either \$6,387 or \$7,729 depending on their qualifications. The salary schedule also provides for periodic increases above this amount. A large majority of experienced landscape architects in the Federal Government earn \$9,221 a year or more; a few earn \$15,000 or more.

Salaried employees in both the government and in landscape architectural firms usually work regular hours. Self-employed persons often work long hours, especially during the planting season. Salaried employees in private firms may also work overtime during seasonal rush periods.

### Where To Go for More Information

Additional information on the profession and a list of colleges and universities offering accredited courses of study in landscape architecture may be obtained from:

American Society of Landscape Architects, Inc.,  
2000 K St. NW., Washington, D.C.  
20006.

### LAWYERS

(D.O.T. 110.108 and .118 and 119.168)

### Nature of Work

Most people, at some time in their lives, need legal advice and help. For

this they turn to lawyers, who advise them of their legal rights and obligations and, when necessary, represent them in courts of law. In addition, lawyers (also called *attorneys*) negotiate settlements out of court and represent clients before quasi-judicial and administrative agencies of the government. They may act as trustees, guardians, or executors. Government attorneys play a large part in developing and administering Federal and State laws and programs; they prepare drafts of proposed legislation, establish law enforcement procedures, and argue cases.

A majority of lawyers are engaged in general practice, handling all kinds of legal work for clients. However, a significant number practice in a particular branch of the law, such as, corporation, criminal, labor, patent, real estate, tax, or international law. Some attorneys devote themselves entirely to trying cases in

the courts. Others never appear in court but spend all their time drawing up wills, trusts, contracts, mortgages, and other legal documents; conducting out-of-court negotiations; and doing the investigative and other legal work necessary to prepare for trials. Still others are primarily engaged in teaching, research, writing, or administrative activities.

Many people who have legal training are not employed as lawyers but are in other occupations where they can use their knowledge of law. They may, for example, be insurance adjusters, tax collectors, probation officers, credit investigators, or claims examiners. A legal background is also a valuable asset to people seeking or holding public office.

### Where Employed

An estimated 265,000 lawyers were employed in early 1967, the great



majority working full time. Of the total number, approximately 3 out of 4 were in private practice. More than half of the private practitioners were in practice by themselves, about 45 percent were in partnerships or worked for other lawyers or law firms.

Government agencies employ the greatest number of salaried attorneys. The Federal Government employed approximately 16,000 attorneys, chiefly in the Department of Justice, the Department of Defense, and the Veterans Administration. About 7,500 attorneys were employed by State governments, and 7,600 held positions with city or county governments. Other salaried lawyers are employed by 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 an independent practice; others do legal work on a part-time basis working primarily in another occupation. Although lawyers practice in all parts of the country, most of them are in cities and in the States which have the greatest population.

### **Training, Other Qualifications, and Advancement**

Before a person can practice law in the court of any State he must be admitted to the bar of that State. In all States, applicants for bar admission must pass a written examination; however, a few States waive this requirement for graduates of their own in-State law schools. Other usual requirements are U.S. citizenship and good moral character. 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 meets the State's standards of good moral character and has a specified amount of legal experience. Special rules of each court or agency control the right to practice before Federal courts and agencies.

To qualify for the bar examinations in the majority of States, an applicant must have completed a minimum of 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. Some States will accept study in a law office instead of, or in combination with, study in a law school—although this method of training is now rare. A few States will accept study of the law wholly in a law office; only two States will accept study of the law by correspondence. A number of States require registration and approval by the State Board of Examiners before students enter law school or during the early years of legal study. In a few States, candidates must complete a period of clerkship in a law office before they are admitted to the bar.

As a rule, 7 years of full-time study after high school are necessary to complete the required college and law school work. The most usual preparation for becoming a lawyer is 4 years of college study followed by 3 years in law school. However, many law schools admit students after 3 years of college work. A few schools, particularly if they have a 4-year, full-time curriculum, may accept students after 2 years of college work. On the other hand, an increasing number of law schools are requiring applicants to have a college degree. Law schools seldom specify the college subjects which must be included in students' prelegal education. However, English, history, economics, and other social sciences, logic, and public speaking are all important for prospective lawyers. In general, their college background should be broad enough to give them an understanding of society and its institutions. 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 166 law schools in existence in 1967, 136 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 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 are usually required to complete the night-school curriculum. In 1966, about one-quarter of all law students in ABA-approved schools were enrolled in evening classes.

The first 2 years of law school are generally devoted to fundamental courses such as contracts, criminal law, and property. In the third year, students may elect 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, in the school's practice court where the students conduct trials under the supervision of experienced lawyers, and by writing on legal issues for the school's law journal. Upon graduation, the degree of bachelor of laws (LL.B.) is awarded by most schools, although many schools confer the juris doctor (J.D.) as the first professional degree. 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 or judges. Initially, 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 progressively responsible salaried employment, during which time they can obtain experience and funds and become better known, many lawyers go into practice for themselves. Some lawyers, after years of practice, become judges.

### Employment Outlook

Graduates from widely recognized law schools and those who rank high in their classes will have very good employment prospects through the 1970's. They are expected to have good opportunities for obtaining salaried positions with well-known law firms, on the legal staffs of corporations and government agencies, and as law clerks to judges. Graduates of the less well-known schools and those who graduate with lower scholastic ratings may experience some difficulty in finding salaried positions as lawyers. However, numerous opportunities will be available for law school graduates to enter a variety of other types of salaried positions requiring a knowledge of law. Law graduates will also be in demand as commissioned officers in the Armed Forces for legal assignments. 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 practice.

Prospects for establishing a new practice will probably continue to be best in small towns and expanding suburban areas. In such communities, competition with other lawyers is likely to be less than in big cities; also, office rent and other business costs may be somewhat lower, and young lawyers may find it easier to become known to potential clients. 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.

Although the majority of employment opportunities for new lawyers will arise from the need to replace those who retire, die, or otherwise leave the field, the total number of lawyers is expected to grow mod-

erately over the long run. However, continuing a recent trend, the number of lawyers in independent practice may remain stable or decline somewhat. Most of the growth will result from the continuing expansion of business activity and population. In addition, the increased use of legal services by low- and middle-income groups will add to the long-term growth in demand for lawyers. For example, expansion of legal services for low-income groups has come about through the Community Action Programs authorized under the Economic Opportunity Act of 1964. The growing complexity of business and government activities is expected to create a steadily expanding demand for lawyers who have extensive experience in corporation, patent, administrative, labor, and international law.

### Earnings and Working Conditions

The average salary of lawyers employed in beginning positions with manufacturing and other business firms was nearly \$7,700 a year in early 1966; those with some experience earned average salaries of \$9,100. Average (median) starting salaries of lawyers employed by cities and counties were about \$7,600 in early 1966, according to the limited data available. In the Federal Government, the annual starting salary for attorneys who had passed the bar was either \$6,451 or \$7,696 in early 1967, depending upon personal qualifications.

Beginning lawyers working for small law offices or engaged in legal aid work usually receive the lowest starting salaries. New lawyers starting their own practices may earn little more than expenses during the first few years and may find it necessary to work part time in another occupation.

Lawyers' earnings generally rise with increased experience. Those employed on a salaried basis receive increases as they demonstrate their ability to assume greater responsibil-

ities. In early 1966, the average annual salary of attorneys in private industry who were in charge of legal staffs was about \$27,000. Incomes of lawyers in private practice usually grow as their practices develop. Private practitioners who are partners in law firms generally have greater average incomes than those who practice alone.

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 the usual retirement 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 Bar 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, Ill.  
60637.

Association of American Law Schools,  
1521 New Hampshire Ave. NW.,  
Washington, D.C. 20036.

### LIBRARIANS

(D.O.T. 100.118 through .388)

#### Nature of Work

Recording and making information widely available is the job of librarians. Librarians select and organize collections of books, pamphlets, manuscripts, periodicals, clippings, and reports, and assist readers in their use. In many libraries, they may also make available phonograph records, maps, slides, pictures, tapes, films, paintings, braille, and talking books. In addition to classifying and cata-

logging books and other loan items, they publicize library services, study the reading interests of people served by the library, and provide a research and a reference service to various groups of people. Librarians may also review and abstract published materials, and prepare bibliographies.

In a small library, a librarian performs a great variety of tasks. In a large library, each librarian may perform only a single function such as cataloging, publicizing library services, or providing reference service, or he may specialize in a subject area such as science, business, the arts, or medicine.

Librarians may be classified by the type of library in which they are employed: Public library, school library, college or university library, or special library. In each of these types, there are two principal kinds of library work—reader services and technical services. Those who perform reader services—for example, reference librarians and children's librarians—work directly with the public. Librarians who perform technical services, including those who process books, such as catalogers or acquisition librarians often deal less directly with the public.

*Public librarians* serve all kinds of readers—children, students, teachers, research workers, and others. Increasingly, librarians are providing special materials and services to culturally and educationally deprived people. The professional staff of a large public library system may include the chief librarian, an assistant chief, and several division heads, who plan and coordinate the work of the entire library system. Such a system may also include librarians who supervise branch libraries, and other librarians who are specialists in certain areas. The duties of some of these specialists are briefly described as follows: *Acquisition librarians* purchase books and other library materials recommended by staff members, keep a well-balanced library in quantity and quality, make sure that the library receives what it orders, and maintain

close contact with book jobbers and publishers. *Catalogers* classify books under various subjects and otherwise describe them so they may be located through catalogs on cards, or in other forms. *Reference librarians* aid readers in their search for information—answering specific questions or suggesting sources of information. This work requires a thorough understanding of bibliographic material and a general knowledge of library materials in various subject fields. *Children's librarians* plan and direct special programs for young people. Their duties include helping children find books they will enjoy, instructing them in the use and content of the library, giving talks on books, and maintaining contact with schools and community organizations. Often they conduct regular story hours at the library and sometimes on radio or television. *Adult services librarians* may select materials for and advise mature readers. They are often asked to suggest reading materials, and to cooperate in, or plan and conduct, educational programs on such topics as community development, public affairs, creative arts, problems of the aging, or home and family life. *Young adult services librarians* may select books and other materials for young people of junior high school and high school age and guide them in the use of these materials. They may arrange book or film discussion groups, concerts of recorded popular and classical music, and other programs related to the interests of young adults. They may also help to coordinate the services of the school libraries and the local public library. *Bookmobile librarians* take library materials to people who live in areas where other public library services are nonexistent or inadequate.

*School librarians* instruct students in the use of the library and visit classrooms to familiarize students with library materials relating to the subjects being taught. They also work with teachers and school supervisors who plan the curriculum. They prepare lists of printed and audiovisual

materials on certain subjects; meet with faculty members to select materials for school programs; and select, order, and organize library materials. Many school librarians are employed by school district central offices as supervisors to plan and coordinate library services for the entire school system, as catalogers, and as librarians to administer professional libraries for teachers. Very large high schools may employ several professional librarians, each responsible for a special aspect of the library program or for special subject materials.

*College and university librarians* work with students, faculty members, and research workers, in general reference work or in a particular field of interest, such as law, medicine, economics, or music. In addition, they may teach one or more classes in the use of the library. Some specialize in acquisition and cataloging. A few librarians, who are employed in university research projects operate documentation centers. Computers and other modern devices are being increasingly used to record and retrieve specialized information.

*Special librarians* work in libraries maintained by commercial and industrial firms, such as pharmaceutical companies, banks, and advertising agencies; professional and trade associations; government agencies; and other types of organizations such as hospitals and museums. These librarians plan, acquire, organize, catalog, and retrieve information from collections designed to provide intensive coverage of information resources about subjects of special interest to the organization. The special librarian utilizes his extensive knowledge of the subject matter, as well as of library science, in building up library resources, advising and assisting library users, abstracting, and routing available materials. Literature searching and the preparation of summaries, translations, bibliographies, and special reports are among the major duties of special librarians.

*Science information specialists*, like special librarians, work in technical

libraries maintained by commercial and industrial firms. However, they must possess a more extensive technical and scientific background than special librarians. They not only perform many of the duties of special librarians, but they also develop coding and programing techniques for using electronic and electromechanical information storage devices and abstract complicated information into short, readable form, and interpret and analyze data for a highly specialized clientele.

### Where Employed

In 1966, about 81,000 people were employed as full-time professional librarians. Of this group, school librarians accounted for about two-fifths; public librarians represented more than one-fourth; librarians in colleges and universities and those employed in special libraries (including libraries in government agencies), each accounted for about one-sixth. A large number of partly trained and part-time people were also working as librarians. A small number of librarians were employed as teachers and administrators in schools of library science.

About 80 percent of all librarians are women. Men are more frequently employed than women in executive and administrative positions in large library systems and in special libraries concerned with science and technology.

Most librarians work in cities and towns. Those attached to bookmobile units serve widely scattered population groups mostly in suburban or rural areas. Rural, suburban, and town public libraries are being organized increasingly into county and multicounty systems, with centralized reference and technical services.

### Training, Other Qualifications, and Advancement

To qualify as a professional librarian, one must ordinarily have com-

pleted a course of study in a graduate library school. This usually means at least 5 years of college—4 to meet requirements for a bachelor's degree and a fifth year or more of specialized study in library science, after which the master's degree is conferred. A growing proportion of the persons in administrative and other high-level library positions have such training. A Ph. D. degree is an advantage to those who plan a teaching career in library schools or who aspire to a top administrative post, particularly in a college or university library or in a large school library system. For those who are interested in the special libraries field, a doctorate in a scientific subject field would also be highly desirable.

In 1967, there were 36 library schools in the United States which were accredited by the American Library Association. Many other colleges offer courses within their 4-year undergraduate programs as well as at the graduate level which prepare students for some types of library work.

Entrance requirements to graduate schools of library science commonly include (1) graduation from an accredited 4-year college or university, (2) a good undergraduate record, and (3) a reading knowledge of at least one foreign language. Some schools also require introductory undergraduate courses in library science. Most library schools emphasize the importance of a liberal arts undergraduate program with a major selected from one of the following: Social sciences, physical and biological sciences, the arts, or comparative literature. Some schools require entrance examinations.

Special librarians and science information specialists must have extensive knowledge of the subject with which their work will deal, as well as training in library science. In libraries devoted to scientific information, librarians must know well one foreign language or more. They must also be well informed about new equipment, methods, and techniques

used in storing and recalling technical information.

Many students attend library schools under cooperative work-study programs, combining their academic program with practical work experience in a library. To aid the student in arranging his work-study schedule, many schools offer all courses every semester. Scholarships for training in library science are available under certain State and Federal programs and from library schools, as well as from a number of the large libraries and library associations. Numerous loans, assistantships, and financial aids are also available.

School librarians must be certified in most States as having met the requirements for both librarians and teachers. Sometimes local, county, or State authorities establish other requirements, based on different combinations of education and experience. In the Federal Government, beginning positions require completion of a 4-year college course and all work required for a master's degree in library science or the equivalent in experience. Candidates who have a year of work experience in library science are eligible for appointment to a higher grade.

In addition to an appropriate educational background, a person interested in becoming a librarian should have above-average intelligence, an interest in people, an attraction to books, intellectual curiosity, an ability to express himself clearly, a desire to search for and use recorded materials, and an ability to work harmoniously with others.

Experienced librarians may advance to administrative positions or to specialized work. Promotion to these higher positions may be limited, however, to those who have completed graduate training in a library school, or to those who have had specialized training and experience.

### Employment Outlook

The employment outlook for trained librarians is expected to be

very favorable through the mid-1970's. A nationwide shortage of trained librarians existed in early 1967 and is expected to continue despite the anticipated rise in the number of library school graduates. Thus, it appears that qualified librarians will have excellent employment opportunities in most parts of the country and in all types of libraries. The best opportunities in the order named, will probably be in school libraries (especially at the elementary school level), special libraries, children's libraries, and college and university libraries (especially in research, subject specialties, and some languages).

Persons who have only a bachelor's degree with a major in library science, as well as some college graduates who have had little or no library training probably will continue to find employment opportunities in libraries. Many part-time positions will also be available for persons trained in library work. Retired librarians should be able to find employment in short-term positions as consultants, as substitutes for librarians during vacation periods, or in other types of library work. Jobs for library assistants will also be available for college students or other persons interested in gaining library experience.

The demand for fully qualified professional librarians to meet the requirements of a growing and increasingly well-educated population will be intensified by the vast and continuing expansion in the volume and variety of materials which must be processed for reader use. Also, because of the ever-increasing demands upon high-level executives in business and industry, management will rely more heavily on the services of special librarians and science information specialists to keep abreast of new developments. The increase of Federal aid through the Library Services and Construction Act of 1964, the Elementary and Secondary Education Act of 1965, and the Higher Education Act of 1965, as amended, may further increase the demand for li-

brarians. Improved standards for school and college libraries and the expanding student population will also necessitate the employment of a growing number of fully trained librarians. Furthermore, as new methods of storing and retrieving information by means of computer equipment are developed, demand for science information specialists will be very great. Especially well-qualified librarians will probably continue to find some opportunities for employment in the Armed Forces and U.S. Information Agency overseas. Several thousand librarians will also be needed each year to fill positions vacated by young women who leave their jobs to care for their families, and to replace librarians who transfer to other types of work, retire, or leave the field for other reasons. Opportunities for women wishing to reenter the field are favorable; especially for those who take the necessary courses in library science.

### Earnings and Working Conditions

The average annual starting salary of new library school graduates was about \$6,700 in 1966. Specialists with extensive experience earned up to \$15,000 or more. The degree of responsibility and technical skill required, as well as geographical location, size, and type of library are important factors which determine librarians' salaries.

Public libraries serving large cities and urban-centered county library systems paid new library school graduates between \$6,000 and \$6,300 in 1965. Department heads in these libraries earned between \$9,000 and \$11,000 a year; some chief librarians earned \$12,000 and over. The heads of the libraries in large cities had annual salaries of \$16,000 or more.

In the Federal Government, the annual entrance salary for librarians with at least 1 year of graduate study leading to a degree in library science, was \$6,450 in early 1967; for those who also had a year of experience, it

was \$7,700. Many in supervisory and administrative positions earned annual salaries up to \$17,550.

In 1967, the median starting salaries of *special librarians* with a master's degree in library science generally were \$6,950. Experienced special librarians and information specialists who had a Ph. D. degree in a subject matter field generally earned between \$10,000 and \$15,000 a year.

The higher paying positions are found in school, college, and special libraries rather than in public libraries. Librarians who have an advanced degree in any field and teaching or administrative experience will find best salaries in academic or special libraries.

The typical workweek for librarians is 5 days, amounting to from 35 to 40 hours. The work schedule of public and college librarians may include some Saturday, Sunday, and evening work. School librarians generally have the same workday schedule as classroom teachers. A 40-hour week during normal business hours is common for government and other special librarians.

The usual paid vacation after a year's service is 3 to 4 weeks. Vacations may be longer in school libraries, and somewhat shorter in those operated by business and industry. Many librarians are covered by sick leave; life, health, and accident insurance; and pension plans.

### Where To Go for More Information

Additional information, particularly on accredited schools, certification requirements, and scholarships or loans may be obtained from:

American Library Association,  
50 East Huron St., Chicago, Ill.  
60611.

Information on requirements and placement of special librarians may be obtained from:

Special Libraries Association,  
31 East 10th St., New York, N.Y.  
10003.

Information on Federal assistance for library training under the Higher



Education Act of 1965 may be obtained from:

Library Services Branch, Office of Education,  
U.S. Department of Health, Education, and Welfare,  
Washington, D.C. 20202.

Individual State library agencies can furnish information on scholarships available through their offices, on requirements for certification, as well as general information about career prospects in their regions. State boards of education can furnish information on certification requirements and job opportunities for school librarians.

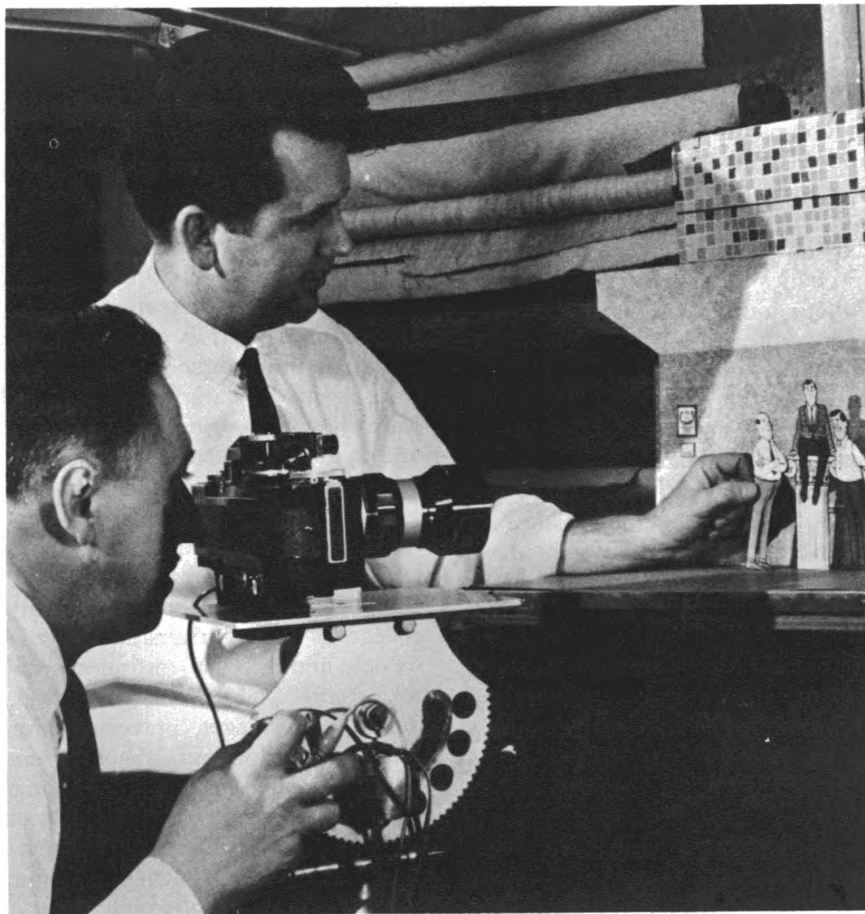
## PHOTOGRAPHERS

(D.O.T. 143.062, .282 and .382)

### Nature of Work

Photography is an artistic and technical occupation involving much more than taking clear pictures of people or scenery. Some photographers produce pictures which are so beautifully composed, otherwise artistic, and striking that they are recognized as works of fine art. Skillful portrait photographers take pictures which are not only natural looking and attractive but express the personality of the individual. Photographing sports and other news events also requires special photographic skills, as do other areas of photographic work.

The work of photographers varies greatly, depending upon the particular area of specialization; however, all photographers use equipment and materials that are basically the same. Photographers use a variety of cameras; still, motion picture, self-developing, and others. The cameras may be equipped with telephoto, wide-angle, or other special lenses, and have different types of light filters to enable the photographer to get the particular effects desired in each picture. Photographers also utilize many kinds of film and must know which to use for each type of picture,



Photographers take pictures with many kinds of cameras.

lighting condition, and camera. The photographer must be able to select the proper filter to be used with different film. When taking pictures indoors or after dark, they use lighting equipment—flash bulbs for some pictures, flood and other special lights and reflectors for others. In addition, photographers must be able to carry through the chemical and other processing by which pictures are developed, enlarged, and printed. In small shops and photographic departments, the photographer often has to do all this technical work; as a rule, large studios employ photographic technicians to do the needed technical work. The techniques involved in taking motion pictures differ greatly from those used in still photography and, therefore, most photographers restrict themselves to one field or the other.

Photographers also should have some knowledge of art and design; use of makeup and props; and proportion and composition. In addition, photographers must be able to arrange their subjects properly against the background or setting.

Many professional photographers specialize in particular areas, such as portrait photography, commercial photography, or industrial photography. Portrait photographers work in their own studios, although they also go to people's homes and other places to take pictures. Commercial photographers generally take pictures for use in advertising real estate, furniture, food, apparel, and other items, but they may also do other kinds of photographic work. The work of the industrial photographer is similar to that of the commercial photographer. Generally, he works for a single firm

or company, mainly taking pictures that are used in company publications and for advertising company products or services. They may take motion pictures of workers on the job and of equipment and machinery operating at high speed to simplify work methods or to improve the production process. Other photographic specialties include press photography (photo journalism that combines a "nose for news" with photographic ability); aerial photography; instrumentation photography; illustrative photography; educational photography (preparing slides, film strips, and movies for use in the classroom, for example); and science and engineering photography (the development of photographic techniques for use in space photography and related fields). Some photographers write for trade and technical publications, act as representatives of photographic equipment manufacturers, manage photo-finishing establishments, sell photographic equipment and supplies, produce documentary films, or do freelance work.

### Where Employed

About 54,000 photographers were employed in early 1967. Approximately half of them worked in portrait or commercial studios—many in business for themselves, the rest as salaried employees. In addition, sizable numbers were employed in industry; some worked for Federal, State, and local government agencies; and others operated camera stores or worked on the staffs of newspapers and magazines. Still others worked as freelance photographers, taking pictures of many kinds and selling them to advertisers, magazines, and other customers.

Photographers work in all parts of the country, in small towns as well as large cities. They are concentrated, however, mainly in States which are heavily populated—California, New York, Pennsylvania, Ohio, and Illinois—and which also have great

numbers of businesses and industrial establishments.

### Training, Other Qualifications, and Advancement

After graduating from high school, young people may prepare for work as professional photographers through 2 or 3 years of on-the-job training in a portrait or commercial studio. A trainee generally starts by working in the darkroom, where he learns how to develop and print film and to do other related work such as making enlargements. Later, he may set up lights and cameras or otherwise assist an experienced photographer in taking pictures. Photographic training can also be obtained in many colleges and universities, trade schools, and technical institutes, or by taking correspondence school courses. There are colleges, universities, or other institutions in almost every State that offer instructions in some area of photography. Several colleges and universities offer 4-year curriculums leading to a bachelor's degree with a major in photography. These curriculums include liberal arts courses as well as courses in professional photography. The master's degree with a major in various specialized areas, such as, color photography, is offered by some colleges and universities. A few institutions have 2-year curriculums leading to a certificate or an associate degree in photography. Training in design at art schools or institutes is also useful, although these schools usually do not provide the technical training for camera work. (See statement on Commercial Artists.) Some photographers are trained in 3-year apprenticeship programs. Also, many young people become photographers while in the Armed Forces.

The kind and amount of training obtained greatly influence the kind of photographic work for which a young person can qualify. Amateur photographic experience may be helpful to the young person considering entry jobs in this field.

Considerable formal post-high school training, plus some photographic experience, is usually needed to enter industrial, news, or scientific photography. Photographic work in scientific and engineering research generally requires a background in science or engineering as well as skill in photography.

The prospective photographer should have manual dexterity and some artistic ability. In addition, a pleasant personality, the ability to put people at ease, and a good business sense are needed by photographers who expect to go into business for themselves. Imagination and originality are particularly important assets for successful careers in commercial photography or freelance work. For press photography, a knowledge of news values and the ability to act quickly are important.

Beginning photographers often work in established studios until they accumulate the capital and experience needed to start their own businesses, although some open their own portrait or commercial studios immediately after completing their training.

### Employment Outlook

Employment opportunities are expected to be favorable for the rest of the 1960's and through the 1970's for talented and well-trained photographers, particularly those having good technical backgrounds. People who have less ability and training are likely to encounter keen competition and limited chances of advancement.

Competition for employment in the portrait and commercial fields of photography is keen; nevertheless, opportunities exist for those who are competent and well trained. These fields may be entered easily, since a photographer can go into business for himself without a large financial investment. Moreover, the available supply of portrait and commercial photographers is continually enlarged by people who are employed in other

occupations but who take pictures in their spare time.

Opportunities are expected to be favorable for photographers working in industrial photography, scientific and engineering photography, illustrative photography, photo-journalism, and other highly specialized areas that require a thorough knowledge of photography as well as some training in a technical or scientific field. In coming years, the employment of industrial photographers is expected to rise at a more rapid pace than that of either portrait or commercial photographers.

Slow increase in employment of photographers is expected over the 1970's as the economy grows and becomes more complex. Major factors contributing to this growth are the increasing use of photographers in research and development in industry and government and the more widespread production of audio-visual aids, such as slides, film strips, and motion pictures for use by business, industry, civil organizations, and government. Because of advances in photographic technology, such as more sophisticated cameras and improved color and high-speed photography, more and more business concerns and other organizations are utilizing photographic work. This, in turn, is adding to the demand for well-qualified photographers. Population expansion and the growth of the suburbs will also create some opportunities for photographers to open portrait studios in new shopping centers.

It is estimated that approximately 1,500 workers will be needed each year to fill new positions and to replace photographers who retire, die, or stop working for other reasons. Still other workers will be needed to replace photographers who transfer to other types of employment.

### Earnings and Working Conditions

Beginning photographers generally earned from \$85 to \$105 a week in early 1967, according to limited in-

formation from various private sources. Many photographers who have established reputations earned much more. For newspaper photographers without previous experience and employed on most daily newspapers having contracts with the American Newspaper Guild, minimum starting salaries ranged from about \$80 to \$115 a week for those working on a few small dailies, the Guild minimum starting salaries were less than \$75 a week; on a few large dailies, Guild minimum rates for beginning photographers approached \$130 a week or more. Photographers who have a science or engineering background usually received beginning salaries of between \$7,000 to \$8,500 a year.

Minimum rates for newspaper photographers with some experience (usually for those with 4 to 6 years) ranged from about \$140 to \$180 a week in early 1967. Contract minimum for experienced newspaper photographers on a few small dailies was less than \$135 a week; on a few large dailies, they ranged from about \$190 to \$200 a week. Many newspaper photographers earn \$250 a week or more.

Depending on the level of experience, the entrance salary for photographers in the Federal Civil Service ranged from \$4,776 to \$7,696 a year in early 1967. In addition, the salary schedule provides for periodic increases above this amount. Most experienced photographers in the Federal Government earned between \$5,331 and \$10,045 a year; a few earn over \$15,000 annually. Self-employed photographers generally earn more than salaried workers, but their earnings are affected greatly by business conditions and many other factors.

Photographers with salaried jobs usually work the standard 5-day, 40-hour week and receive benefits such as paid holidays, vacations, and sick leave. Photographers in business for themselves frequently work longer hours, especially during their busy seasons. Working conditions are generally pleasant. Freelance, press, and

commercial photographers may be required to travel frequently.

### Where To Go for More Information

Information about photography as a career, as well as a list of schools of photography, is available from:

Professional Photographers of America, Inc.,  
1090 Executive Way, Oak Leaf Commons,  
Des Plaines, Ill. 60018.

### PROGRAMMERS

(D.O.T. 020.188)

### Nature of Work

An electronic computer, even though sometimes called a "*mechanical brain*," can only follow step-by-step instructions that tell it exactly what to do. The programmer prepares these instructions.

A computer not only makes mathematical calculations at fantastic speeds, but stores many thousands of facts in its "memory" and later uses them to carry out its work. Because computers are able to work with masses of figures and facts at tremendous speed and with a high degree of accuracy, they are used for a great deal of "data processing" which would otherwise require the time of many employees. They handle such varied assignments as keeping inventories, controlling production machinery in factories, making long-range weather forecasts, doing legal research, and analyzing air traffic patterns. Some are tasks that could never be attempted on the same scale without a computer because of the excessive amount of time required. Still others, such as controlling the flight of a missile by instantaneously correcting deviations from the planned course, are tasks that would be impossible to accomplish without the speed of a computer.

Every "problem" processed in a computer must first be carefully



Computer programmer checks results of test run with console operator.

analyzed so that exact and logical steps for its solution can be worked out. In some cases, the preliminary work is done by an experienced programmer; in others, it may be done by a specialist known as a systems analyst. (See the statement on electronic data processing systems analysts elsewhere in the *Handbook*.)

Once this preliminary work has been completed, the "program," or detailed instructions for processing the data can be prepared by the programmer. Exactly how he goes about this depends not only on the type of equipment to be used, but on the nature of the problem. The mathematical calculations involved in billing a firm's customers, for example, are very different from those required

in most kinds of scientific and technical work. The programming techniques are also different. Still other techniques are required in writing programming "aids" which reduce the amount of detail associated with programming. Because of these differences, many programmers specialize in certain kinds of work.

In business offices, where computers are frequently used to bill customers, make up payrolls, and keep track of inventories, the programmer often starts his work by determining just which facts must be used to prepare documents such as customers' bills or employees' paychecks, and by ascertaining the exact form in which these facts are entered on company records. He then makes a flow chart,

or diagram, showing the order in which the computer must perform each operation, and for each operation he prepares detailed instructions. These instructions, when they are relayed to the computer's control unit, tell the machine exactly what use is to be made of each piece of information, in order to produce each employee's paycheck or other business document. The programmer is also responsible for preparing an instruction sheet for the console operator to follow when the program is run on the computer. (The work of the console operator is described in the chapter on Clerical and Related Occupations.)

The final step in programming is "debugging"—that is, checking on whether the instructions have been correctly written and will produce the desired information. A program is usually debugged in two steps. First, the programmer takes a sample of the data to be processed and reviews step by step just what will happen as the computer follows the series of instructions which make up the program. Then, after he has revised the instructions to take care of any difficulties that have appeared, he completes the test by having a trial run made in the computer. The console operator sometimes helps with this part of the debugging process.

A comparatively simple program can be made ready for a computer within a very few days. A program which deals with a complex problem or is designed to produce many different kinds of information may require a year or more of preparation—sometimes by a large number of programmers. On involved problems, several programmers at different levels of responsibility often work as a team, under the supervision of a senior programmer.

### Where Employed

It is estimated that more than 100,000 programmers were employed in mid-1966. In addition, some professional workers such as engineers, scientists, mathematicians, econo-

mists, and accountants spend a portion of their time doing programing.

Programers are employed chiefly by large business organizations and government agencies. A great many work for insurance companies and banks, public utilities, wholesale and retail establishments, and manufacturing firms of almost every kind. A considerable number are government employees doing work related either to scientific and technical problems, or to the processing of the vast amount of paperwork which must be handled in many government offices. In addition, a growing number of programers are employed by computer manufacturers and independent service organizations which furnish computer and programing services to business firms and other organizations on a fee basis.

### **Training, Other Qualifications, and Advancement**

The special abilities most sought after by employers when they hire programers are similar for all types of positions, but requirements with respect to education and experience may be very different, depending mainly on the nature of the problems with which the programer will be dealing. Some programers are college graduates with degrees in engineering, for example, whereas others have had years of experience in such work as accounting or inventory control.

In selecting programers, employers look for people with an aptitude for logical thinking and the exacting kind of analysis which is part of the job. The work also calls for patience, persistence, and the ability to work with extreme accuracy. Ingenuity and imagination are particularly important in some jobs where programers have to work out new ways of arriving at solutions to problems.

In organizations which use their computers for scientific and engineering work, most programers are college graduates, usually with degrees in engineering, the physical sciences,

or mathematics. Graduate degrees may be required for some positions; for almost all positions, an applicant who has no college training is at a severe disadvantage.

Employers who use computers to process business records generally place somewhat less emphasis on technical college training. Many regard previous experience in related work—in machine tabulation, for example, or in payroll work or accounting—equally important and fill many of their programer positions by promoting qualified employees with such experience. When employers find it necessary to hire outsiders, however, they usually give preference to applicants with education beyond high school. College courses in the general field of electronic data processing, or in accounting, business administration, engineering, or mathematics provide especially good preparation.

Entrance requirements for jobs in the Federal Government are much the same as those in private industry. For practically all entry programer positions in the Government, persons hired must have a college degree, preferably with training in mathematics, or else the equivalent of such preparation in previous work experience.

Young people interested in programing jobs can acquire some of the necessary skills at a steadily increasing number of technical schools, colleges, and universities. The instruction available ranges from introductory home study and extension courses to advanced work in computer technology at the graduate level. Courses in computer programing are also open to high school students in many parts of the country. High school and post-high school instruction do not entirely eliminate the need for on-the-job training, however. Since technological changes are continually taking place in this field and each type of computer has its own special programing requirements, some additional training is often necessary even in the case of experienced

programers who change from one job to another.

Most beginners in this occupation start by attending training classes for a few weeks and then, as they work on minor programing assignments, continue with further specialized training. A year or more of experience is usually necessary before a programer can handle all aspects of his job without close supervision. Once he becomes skilled, his prospects for further advancement are good. Experienced and capable programers are in strong demand. In organizations employing several programers, promotion may be to a senior programing job with supervisory responsibilities. Advancement may also be to a position as systems analyst. An increasing number of programers eventually move up to management positions with their firms.

### **Employment Outlook**

Many thousands of new jobs for programers will become available each year during the remainder of the 1960's and through the 1970's. Employment is expected to increase very rapidly, as an expanding and increasingly complex economy causes computers to become increasingly useful to business and government, and as the number of computer installations also rises rapidly. The increase in employment is expected to be particularly sharp in firms which use computers to process business records or to control manufacturing processes.

The rise in employment could well be accompanied by changes in the nature of the work done by programers. Largely because of advances in programing techniques and equipment—innovations such as "automatic programing," the use of programs and parts of programs stored in libraries for future use, and other changes—much is being done to eliminate the routine work associated with writing a program. As a consequence, professionally trained personnel qualified to handle both the

programming and the systems analysis, in the areas of their specialties, are likely to be increasingly in demand for work on scientific and engineering problems. For other positions, many of them in large business offices where the analysis is done by accountants and other subject matter experts, there is some evidence that 2 years of intensive training at the post-high school level may provide a sufficient background for beginning programmers.

Most of the openings for programmers in the years just ahead will be new jobs that arise as the number of computer installations continues to increase and computers are put to new uses. Some openings will also occur as programmers advance to more responsible positions, or as they leave their jobs to enter other types of employment. Because this occupation includes many comparatively young workers, few positions are likely to become vacant because of retirement or death.

### Earnings and Working Conditions

In 1966, salaries ranged from an average of about \$7,300 a year for beginners to between \$9,600 and \$11,000 for experienced programmers, according to a private survey which covered more than 2,000 business firms in all parts of the country. Programmers with supervisory duties averaged up to \$12,000 a year. The survey indicated substantial differences in the salaries of the lowest and highest paid individuals in the same kinds of positions, however, with some earning up to three times as much as others in the same group. These differences were probably due partly to the kind of data processed and the kind of computer used, and partly to the industry involved and its location.

Federal Government salaries for programmers are comparable with those in private industry. The great majority earn between \$6,451 and \$14,217 a year. The minimum entrance salary for beginners was \$5,331 a year in early 1967, and the top salaries of ex-

perienced programmers responsible for complex programming or supervisory and administrative work ranged to \$17,550 or more a year.

The standard workweek for programmers is usually the same—about 40 hours—as the workweek for other professional and office workers. Unlike many computer console and auxiliary equipment operators who work on a 2- or 3-shift basis, programmers usually work only during the day. Occasionally evening or weekend work may be necessary—for example, when it proves particularly difficult to “debug” a program.

Work places are usually modern offices, well-lighted and air conditioned. Employers recognize the desirability of providing the best possible work surroundings, because programmers working under such conditions can concentrate more readily on the very exacting kind of analysis which is an essential part of their job.

### Where To Go for More Information

Additional information about the occupation of programmer may be obtained from:

Data Processing Management Association, 524 Busse Highway, Park Ridge, Ill. 60068.

A list of reading materials on career opportunities in programming may be obtained from:

Association for Computing Machinery, 211 East 43d St., New York, N.Y. 10017.

## PSYCHOLOGISTS

(D.O.T. 045.088 and .108)

### Nature of Work

The problems of severe emotional stress and abnormal behavior, the causes of low morale, or the effective performance of an astronaut in a space capsule, are among the concerns of psychologists seeking to understand people and to explain their

actions. Psychologists study the behavior of individuals and groups and often help individuals achieve satisfactory personal adjustments. Their work includes varied activities such as teaching in colleges and universities; counseling individuals; planning and conducting training programs for workers; performing basic and applied research; advising on psychological methods and theories; and administering psychology programs in hospitals, clinics, research laboratories, and other places.

Psychologists obtain information about the capacities, traits, and behavior of people in several ways. They may interview individuals, develop and administer tests and rating scales, study personal histories, and conduct controlled experiments. In addition, psychologists often conduct surveys, either by personal interviews or by circulating questionnaires.

Psychologists usually specialize in one of the many interrelated branches of the profession. Clinical psychologists are the largest group of specialists. Generally, they work in mental hospitals or clinics and are concerned mainly with problems of mentally or emotionally disturbed people. They interview patients, give diagnostic tests, and provide individual and group psychotherapy. Other specialties in psychology include experimental psychology (the study of basic learning and motivation); developmental psychology (the study of special age groups such as young children, teenagers, and the aged); personality and social psychology (the study of the social forces that affect individuals and groups); comparative psychology (sometimes called animal psychology); physiological psychology (the relationship of behavior to physiological processes); counseling psychology (helping people achieve satisfactory personal, social, educational, or occupational adjustments); educational psychology (the study of educational processes); industrial psychology (developing techniques for selecting and training workers and improving worker moti-

vation and morale); and engineering psychology (the study of man-machine and other complex system relationships).

### Where Employed

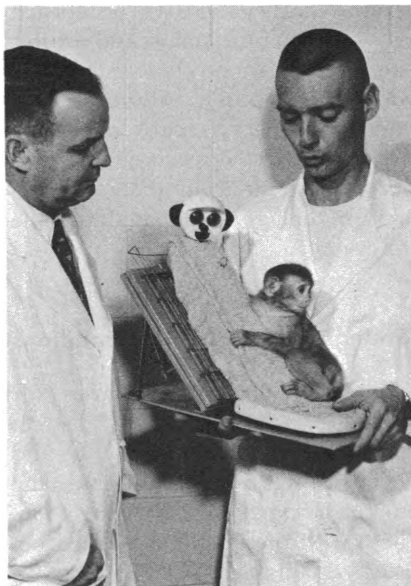
Psychologists teach and work in college classrooms, hospitals, research laboratories, or business offices. Most psychologists are employed in large cities and in university towns, but some are on the staffs of institutions located in rural areas. Altogether, an estimated 25,000 psychologists were employed in 1966. About one-fifth of all psychologists were women.

Colleges and universities employ the largest number of psychologists—nearly two-fifths 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.

Many psychologists also work for elementary and secondary schools, for private industry, and for non-profit foundations and clinics. Some are in independent practice, and others serve as commissioned officers in the Armed Forces and the Public Health Service. In addition to positions with the title "psychologist," many personnel and administrative jobs are filled by persons trained in psychology.

### Training, Other Qualifications, and Advancement

Generally, the master's degree with a major in psychology is the minimum educational requirement for professional employment in the field. Psychologists with this degree can qualify for positions where they administer and interpret psychological tests, collect and analyze statistical data, and research experiments, and perform routine administrative duties.



Experimental psychologists study animals for insight into human behavior.

In addition, they may teach in colleges, help counsel students or handicapped persons, or—if they have had previous teaching experience—act as school psychologists or counselors. (See statements on School Counselors and Rehabilitation Counselors.) Because of the current shortage of psychologists, applicants who have only a bachelor's degree with a major in psychology may be employed for certain jobs in work related to psychology, or in other fields where training in psychology is helpful, as in administration.

The Ph. D. degree is needed for many entrance positions and is becoming increasingly important for advancement. Psychologists with doctorates are eligible for the more responsible research, clinical, and counseling positions, as well as for the higher level positions in colleges and universities, and in Federal and State programs.

At least 1 year of full-time graduate study is needed to earn the master's degree, and most students take longer. For the Ph. D., degree a total of 4 to 6 years of graduate work is usually required. In clinical or counseling psychology, the requirements for the Ph. D. degree generally in-

clude 1 year of internship or supervised experience.

The American Board of Examiners in Professional Psychology offers diplomas in the specialties of clinical, counseling, and industrial psychology to those with outstanding educational records and experience who can pass the required examinations.

Some universities require an undergraduate major in psychology for admission to graduate work in that field. Others prefer students with a broader educational preparation, including not only some basic psychology courses but also courses in the biological, physical and social sciences, statistics, and mathematics.

Many graduate students receive financial help from universities and other sources in the form of fellowships, scholarships, or part-time employment. Several Federal agencies provide funds to graduate students, generally through the educational institution giving the training. The Veterans Administration offers a large number of predoctoral traineeships, during which time the students receive payments and gain supervised experience in VA hospitals and clinics. The Public Health Service supports doctoral study in psychology by providing funds for predoctoral and postdoctoral traineeships and research fellowships. The National Science Foundation, the U.S. Office of Education, the Vocational Rehabilitation Administration, and the National Institute of Mental Health also provide funds (fellowships, grants, and loans) for advanced training in psychology.

Psychologists desiring to enter independent practice must meet certification or licensing requirements in an increasing number of States. In 1966, 30 States had such requirements.

### Employment Outlook

Employment opportunities for psychologists who have doctor's degrees are expected to be excellent through the 1970's. Psychologists

holding master's degrees will be in considerable demand but their opportunities for full professional employment will be less favorable than for those with the Ph. D. degree. In early 1967, the supply of well qualified psychologists was inadequate to meet the demand and this situation is expected to persist for the remainder of the 1960's and over the next decade.

Continued rapid expansion of the profession is expected through the 1970's. A large increase is anticipated in the number of psychologists employed by State and local agencies. Currently understaffed mental hospitals and mental hygiene clinics, and community mental health centers will need many clinical, counseling, social, and physiological psychologists. Prisons, training schools, and other State institutions are expected to use psychologists more extensively in the future.

Increasing awareness of the need for testing and counseling children, combined with growing school enrollments, is expected to increase the need for psychologists in both elementary and secondary schools. In colleges and universities, more psychologists will be needed for student personnel work, as well as for teaching and research. Increased public concern for the development of human resources as evidenced by the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963, as amended, and "Headstart" and other antipoverty programs will further increase the demand for psychologists. 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.

Many openings for psychologists with Ph. D. degrees who are specialists in clinical, counseling, experimental, human engineering, physiological, social, and personnel psychology are expected in the Veterans Administration, the Department of Defense, and in State and local areas.

Many vacancies also will occur each year owing to retirements and deaths. The transfer of psychologists to do work of a purely administrative nature may also create some job vacancies. Most opportunities, however, will result from the rapid expansion that is anticipated for the profession.

### Earnings and Working Conditions

In 1966, beginning salaries for psychologists with master's degrees were generally between \$7,000 and \$9,000 a year, according to the American Psychological Association. Those with the doctorate earned between \$9,000 and \$11,000 a year. In the Federal Government, psychologists with limited experience but who had completed all requirements for the doctoral degree could start at \$9,221 in early 1967.

Most psychologists can look forward to a growth in earnings as they gain experience. The National Science Foundation's 1966 National Register of Scientific and Technical Personnel indicates that the average (median) salary of psychologists who have 5 to 9 years of experience was \$10,100 a year and that of psychologists who have 20-24 years of experience about \$13,500. In comparison, average salaries for psychologists who have only 1 year or less of experience were about \$8,500 in 1966.

Self-employed psychologists generally have higher incomes than salaried employees. For example, the median annual salary of self-employed psychologists was \$20,000—more than 30 percent higher than the salary of those employed in industry and nearly 50 percent greater than the salary of those in the Federal Government.

### Where To Go for More Information

General information on career opportunities, certification or licensing requirements, and educational fac-

ilities and financial assistance for graduate students in psychology may be secured from:

American Psychological Association,  
1200 17th St. NW., Washington,  
D.C. 20036.

Information on traineeships and fellowships may be secured from colleges and universities with graduate psychology departments.

## RECREATION WORKERS

(D.O.T. 079.128, 187.118, 195.288)

### Nature of Work

Once leisure was viewed as the companion of idleness, silently stealing the time needed to produce the necessities of life. In recent years, however, new machines and technology have raised the standard of living of most people and provided leisure hours unheard of a short time ago. How people spend their nonworking hours is now a major concern. Recreation workers help people to enjoy and use their leisure time constructively by organizing individual and group activities and by administering physical, social, and cultural programs for all age groups at camps, playgrounds, community centers, and hospitals. They also operate recreational facilities and study the recreation needs of individuals and communities.

Recreation workers employed by local government and voluntary agencies direct activities at neighborhood playgrounds and indoor recreation centers. They provide instruction in the arts and crafts and in sports such as tennis and basketball. They may supervise recreational activities at correctional institutions and work closely with social workers in organizing programs of recreation for the young and the aged at community centers and social welfare agencies.

Many other personnel work in industrial, hospital, or school recreation. Recreation workers in industry plan the recreation programs of company



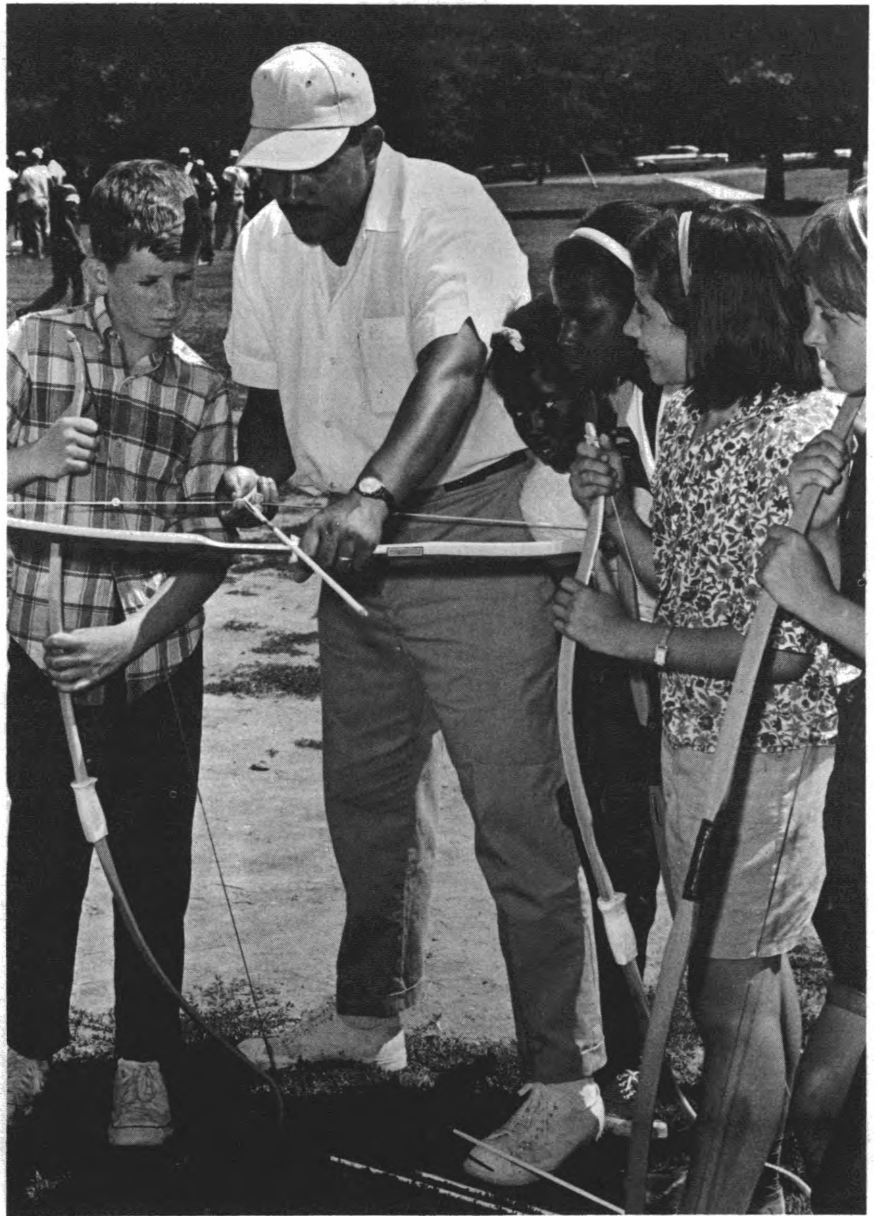
employees and organize bowling leagues, softball teams, and similar activities. Sometimes they plan fund drives and company social functions. Hospital recreation workers plan recreation programs for the ill and the handicapped in hospitals, convalescent homes, and other institutions. Working under medical direction, they organize and direct sports, dramatics, and arts and crafts for persons suffering from mental problems and physical disabilities. School recreation workers organize the leisure-time activities of school-age children during schooldays, weekends, and vacation periods.

Some part-time recreation workers and volunteers assist full-time workers throughout the year, but mostly during the summer months. Part-time workers are largely college students and teachers. They work primarily as recreation leaders and camp counselors, organizing and leading games and other activities at camps and playgrounds.

### Where Employed

About 45,000 recreation workers were employed full time in early 1967. The majority worked for local governments and voluntary agencies. Most of the remainder were employed by religious organizations, or by the Federal Government in national parks, the Armed Forces, the Veterans Administration, and correctional institutions. Some recreational workers were employed by industry and a few were teachers in colleges and universities. In addition to the full-time personnel, more than 100,000 recreation workers were employed for part-time and summer work in parks, camps, and other outdoor settings.

Recreation workers are employed in all parts of the country; however, one-half of these workers are employed in California, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Texas. More than one-third of all recreation workers are women.



### Training, Other Qualifications, and Advancement

Most employers prefer persons who have a bachelor's degree and a major in recreation, social science, or physical education for work in the recreation field. However, fewer than one-half of the recreation workers currently employed have this educational background. Persons interested in becoming recreation workers should take a broad range of courses in college, including philosophy, the

humanities, natural sciences, and the arts. Specialized courses stressing the history, philosophy, and scope of recreation; the techniques of community organization; health and safety procedures; and outdoor recreation are particularly helpful. Advanced courses in recreation or public administration leading to the master's degree are desirable for persons interested in higher level administrative positions; students interested in the field of industrial recreation may find it desirable to take some courses in

business administration. It is important for those interested in working as hospital recreation specialists to take course in psychology, health education, and sociology. Training leading to a bachelor's degree with a major in recreation was available in over 100 schools in 1967. Approximately one-half of these schools offered a master's degree and a doctorate in recreation.

Good health, emotional maturity, and a warm personality are essential qualities for recreation workers. To increase their leadership skills and their understanding of people, interested students should try to obtain related work experience in high school and college. They may do volunteer, part-time, and summer work in recreation departments, camps, youth-serving organizations, institutions, and community centers.

The majority of college graduates entering the recreation field begin as either recreation leaders or specialists, although each year a small number of college graduates enter trainee programs that lead directly to recreation administration. Such programs, offered by a few large cities and organizations, generally last 1 year.

Recreation leaders work directly with groups and individuals, organizing or teaching such diversified activities as athletics, dancing, storytelling groups, and social recreation in indoor and outdoor centers. They may also supervise the work of nonprofessional workers and assist in the administration of recreation programs. Recreation specialists are responsible for the organization and development of one activity, such as swimming and archery, or of several closely related activities. Like recreation leaders, they sometimes oversee the work of nonprofessional workers.

After a few years' experience, recreation leaders and specialists may become recreation directors; those having graduate training, however, may start at this level. Directors are responsible for the operation of the facilities, staff supervision, and the

development and execution of programs at a particular recreation center, as well as the preparation of budgets and the analysis of recreation programs.

Opportunities for advancement to administrative positions are often limited for persons who have no graduate training. However, it is sometimes possible for persons to advance through a combination of education and experience. Administrative jobs require varying years of experience in full-time recreation work, depending upon the size of the community or organization and the program. For example, the minimum recommended experience to become a community recreation supervisor ranges from 1 to 5 years.

### Employment Outlook

Employment of recreation workers is expected to increase very rapidly through the 1970's. Thousands of recreation workers will be needed annually for growth and to replace personnel who leave the field because of retirements, deaths, or transfers to other occupations. In recent years, the number of college graduates having a major in recreation has fallen far short of the demand, and this pattern is expected to continue. Thus, many new recreation workers will continue to be hired from the fields of social science, physical education, and health education. Persons having less than full professional training also will find employment opportunities. As a result of the great demand for recreation workers, part-time and volunteer personnel will be needed, particularly in social welfare agencies and at the local government level.

Other factors that will contribute to growth include increased leisure time and rising levels of per capita income. As income levels rise, expenditures for sports and recreation equipment will increase as more persons participate in a variety of competitive and noncompetitive sports. Larger expenditures will be made for travel to parks and resorts for camp-

ing, hiking, fishing, and other recreational pursuits. Improvements in the national highway system will make many State parks and national forests more accessible to vacationing families. Population growth also will create a demand for more recreation workers to expand existing recreation programs and to aid larger numbers of mentally and physically handicapped persons. Longer life and earlier retirements will increase the number of clubs and organizations for retired persons, and thus increase the need for recreation workers.

Other reasons for the anticipated longrun expansion in the number of recreation workers include a growing interest and participation in recreation activities by the general population; the continued trend toward urban living; the rise in industrial recreation activities as more companies promote recreation programs for their employees; increased attention to physical fitness by government, educators, and others; and the initiation of programs to insure the preservation of outdoor recreation areas. A number of recent Federal laws also will contribute to the rising demand for recreation workers. Among these laws are the Elementary and Secondary Education Act of 1965, which includes provisions for grants to local educational agencies for improving and expanding recreation opportunities for the educationally deprived, and the Older Americans Act of 1965, which provides grants to States for programs, including recreation, for older persons.

### Earnings and Working Conditions

Beginning recreation leaders earned between \$6,500 and \$7,000 annually in 1967, according to the National Recreation and Park Association. In the same year, the salaries of recreation supervisors ranged from \$7,500 to \$10,000, depending upon the size of the community in which they were employed and upon their qualifications. Salaries of recreation executives ranged from \$7,500 in

some small communities to over \$20,000 in many large cities. There were some regional variations in salary levels—higher salaries generally were paid in the West than in other areas of the country.

In early 1967, the annual starting salary for inexperienced recreation workers in the Federal Government was from \$5,331 to \$6,451, depending on their academic records or specialized training. A few recreation workers in top Federal positions earned between \$10,927 and \$15,106 annually.

The average workweek for recreation workers is 40 hours, although some work upwards of 50 hours. A person entering the recreation field should expect some nightwork and irregular hours, for many recreation personnel work while other persons are enjoying their leisure time. Most public and private recreation agencies provide from 2 to 4 weeks' vacation and other fringe benefits, such as sick leave and hospital insurance.

### Where To Go for More Information

Information about recreation as a career and about employment opportunities in the field may be obtained from:

National Recreation and Park Association,  
1700 Pennsylvania Ave. NW., Wash-  
ington, D.C. 20006.

Information about employment opportunities in Veterans Administration hospitals may be obtained directly from the hospitals or the Department of Medicine and Surgery, Veterans Administration, Wash-  
ington, D.C. 20421.

### SOCIAL WORKERS

(D.O.T. 195.108, .118,  
.168, .208, and .228)

#### Nature of Work

Development of a more complex urban society has greatly increased



Medical social worker visits with child.

the need for organized social services. Social workers provide the link between these services and individuals and families who cannot provide for themselves or solve their own problems.

The problems with which social workers are concerned include poverty; broken homes; physical, mental, and emotional handicaps; antisocial behavior; racial tensions; and unsatisfactory community conditions such as inadequate housing and medical care, and lack of educational, recreational, and cultural opportunities. A variety of public and voluntary agencies have social work programs designed to meet specific needs in specific ways; for example, income maintenance programs; family and child welfare services; social services for the crippled, disabled, ill, and aging; and programs for the prevention of juvenile delinquency. Many social work agencies emphasize service to individuals or families; some place primary emphasis on working with larger groups; and still others are concerned mainly with the community's social welfare. These approaches are reflected in the three basic methods of social work practice: Casework, group work, and community organization.

Caseworkers identify the social problems of individuals and families

through interviews. They aid them in understanding their problems and in securing necessary services, including financial assistance, foster care, and homemaker service. Group workers help people through group activities to learn to understand themselves and others better, and to work with others to achieve a common goal. They plan and conduct activities for children, adolescents, and older persons in a variety of settings, including settlement houses, hospitals, homes for the aged, and correctional institutions. Community organization workers help plan and develop health, housing, welfare, and recreation services for a neighborhood or larger area. They often coordinate existing social services and organize fund raising for community social welfare activities.

The majority of social workers provide social services directly to individuals, families, or groups. However, a substantial number perform executive, administrative, or supervisory duties. Still others are college teachers, research workers, or consultants. The wide range of services provided by social workers is suggested by the descriptions of the principal areas of social work which follow:

*Family service workers.* Family service workers are employed by State and local governments and by voluntary agencies. Their duties include determining their clients' needs and providing counseling and social services that strengthen family life and help clients to improve their social functioning. They also advise their clients how to make constructive use of financial assistance and other needed social services.

*Child welfare workers* in government and voluntary agencies are employed to improve the physical and emotional well-being of deprived and troubled children and youth. They advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, arrange homemaker services during a mother's illness, institute legal action for the protection of neglected or mis-

treated children, provide services to unmarried parents, and counsel couples who wish to adopt children. Workers in child welfare may place children in suitable adoptive or foster homes or in specialized institutions.

*School social workers* aid children whose unsatisfactory behavior or progress in school is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school personnel in identifying and seeking solution to the problems that hinder satisfactory adjustment.

*Medical social workers* employed by hospitals, clinics, health agencies, rehabilitation centers, and public welfare agencies aid patients and their families with social problems accompanying illness, recovery, and rehabilitation. They usually function as part of a medical team composed of physicians, therapists, and nurses.

*Psychiatric social workers* provide services for patients in mental health centers, hospitals, or clinics. As members of teams composed of psychiatrists, psychologists, and other professional personnel, they develop and report information on the patient's family and social background for use in diagnosis and treatment. They help patients respond to treatment and guide them in their social adjustment to their homes, jobs, and communities. They carry particular responsibility for working with the families of the patients to facilitate their understanding of the nature of the illness. In some organizations, medical and psychiatric social workers are grouped as "clinical social workers." Psychiatric social workers also participate in community mental health programs concerned with the prevention of mental illness and with the readjustment of mental patients to normal home and community living. Some conduct research.

*Social workers in rehabilitation services* assist emotionally or physically disabled persons in adjusting to the demands of everyday living. As part of a rehabilitation team, which usually includes physical or occupa-

tional therapists, these social workers serve as a link with the community while patients are in the hospital; later, they help them adjust to home and community life. (Rehabilitation counselors, a related occupational group, are discussed in a separate statement.)

*Probation and parole officers* and other correctional workers assist persons on probation and parole and juvenile offenders in readjusting to society. They investigate the social history and background of the person under the jurisdiction of the court and make reports to the courts to help the judge in his judicial decisions. They also counsel persons on probation or parole, may help them secure necessary education or employment, and direct them to other services in the community. They also seek to resolve problems in marital and parent-child relationships.

### Where Employed

More than 150,000 social workers were employed in early 1967. Of this total, approximately 60 percent were employed in State, county, and city government agencies and about 3 percent were in Federal Government organizations. Most of the remainder were in voluntary or private agencies. A small number of experienced social workers from the United States were serving in other parts of the world as consultants, teachers, or technicians engaged in setting up agencies, schools, or assistance programs. They were employed by the Federal Government, the United Nations or one of its affiliated groups, national professional associations, or voluntary agencies.

### Training, Other Qualifications, and Advancement

A bachelor's degree, preferably in social welfare, generally is the minimum educational requirement for beginning jobs in social work. In most fields of practice, certain specialized

areas require a master's degree in social work. For teaching positions, a master's degree in social work is required, and a doctorate is preferred. In research work, training in social science research methods is required, in addition to a graduate degree and experience in social work. In most States, beginners must pass a written examination in social work for employment in a government agency.

A master's degree in social work is awarded on successful completion of 2 years of specialized study and supervised field work in an accredited school of social work. Only graduates of such schools are eligible for membership in the National Association of Social Workers (NASW).

People with 2 years of paid employment in social work under the supervision of a certified social worker and 2 years of membership in the National Association of Social Workers are eligible for certification as members of the Academy of Certified Social Workers (ACSW).

In 1966, there were 63 graduate schools of social work accredited by the Council on Social Work Education. For admission to these schools, a student must have a bachelor's degree representing a broad knowledge of the liberal arts, preferably including courses in economics, history, political science, psychology, sociology, and social anthropology. Courses in biology, statistics, writing, and public speaking are also helpful.

Many scholarships and fellowships are available for graduate education. More than three-fourths of the full-time students in graduate schools receive some scholarship aid granted either by the schools or by employing agencies. Some social welfare agencies, both voluntary and public, offer plans whereby workers are granted "educational leave" to obtain graduate education. The agency may pay the expenses or a salary, or both.

Personal qualities essential for social workers include emotional maturity, objectivity, sensitivity, a basic concern for people and their social problems, and ability to form and sustain good working relationships and

to encourage social adjustment in others. Students should try to obtain as much related experience as possible during high school and college to determine whether they have the interest and capacity for professional social work. They may do volunteer, part-time, or summer work in such places as camps, settlement houses, community centers, or social welfare agencies. Some social welfare agencies, both voluntary and public, hire college students and, in some cases, high school students for nonclerical jobs in which the students assist social workers in case and group work.

### Employment Outlook

Employment opportunities for social workers are expected to be excellent for the remainder of this decade and through the 1970's. Despite the anticipated increase in the number of graduates of master's degree programs in social work, the demand for these highly trained social workers is expected to continue to exceed the supply. The outlook for persons with a bachelor's degree in social welfare or in related fields will continue to be very good. Well qualified and experienced women who wish to work part time should have excellent employment prospects.

Many factors will contribute to the need for more social workers to maintain existing programs and to staff new ones. The occupational structure of the economy is expected to continue to change and create severe problems for many unskilled workers and others whose jobs have been replaced by machines. In addition, family life will continue to be affected by social change. Population growth, especially the increasing numbers of the very young and the very old, the age groups most in need of social work services, is expected to contribute to the demand for social workers. Many openings also will arise because of the need to replace workers who retire, die, or otherwise leave the

### Earnings and Working Conditions

In early 1967, the average (median) starting salary paid social case workers by various State agencies was approximately \$5,100, according to a survey of selected occupations by the Public Personnel Association. In some States, however, annual salaries were considerably above this level. Case work supervisors had average annual salaries ranging from about \$6,700 for those with little experience to \$8,600 for those with considerable experience. The average starting salary of psychiatric social workers was about \$6,600 and beginning salaries of probation and parole officers averaged about \$6,000.

Salaries of social workers in a cross-section of cities and urban counties were, on the average, above those paid by State agencies. For example, according to the survey cited above, the average (median) starting salary of social case workers in selected urban areas was about \$5,800. Salaries of case work supervisors averaged \$7,600 for those with little experience to about \$9,500 for those with considerable experience. Beginning psychiatric social workers had average salaries of about \$7,500 and starting salaries of probation and parole officers averaged about \$6,600.

In the Federal Government in early 1967, graduates of accredited schools of social work received starting salaries of \$6,451 to \$7,696 a year depending on their experience. Those with a bachelor's degree and 3 years' experience in social work in a welfare activity began at \$7,068 a year.

In general, graduates of schools of social work received the highest average salaries. Salaries were usually lower for persons employed in direct-service positions, such as casework or group work, than for persons working in supervisory or executive positions, although salaries paid to persons in direct-service positions in some States and localities exceeded those paid to supervisors in other locations.

The predominant scheduled work-week for social workers in 1967 was generally 40 hours; however, as many

as one-third regularly worked 37½ hours or less a week. In some social work agencies, the nature of the work requires evening and/or weekend work, for which social workers usually receive compensatory time off. Virtually all social work agencies provide fringe benefits such as paid vacations and sick leave and retirement plans.

### Where To Go for More Information

Information on admission requirements and scholarships in accredited graduate schools of social work and colleges offering preprofessional courses in social work, as well as on social work as a career, may be obtained from the National Commission for Social Work Careers, jointly sponsored by the Council on Social Work Education and The National Association of Social Workers. Write to:

National Commission for Social Work  
Careers,  
2 Park Ave., New York, N.Y. 10016.

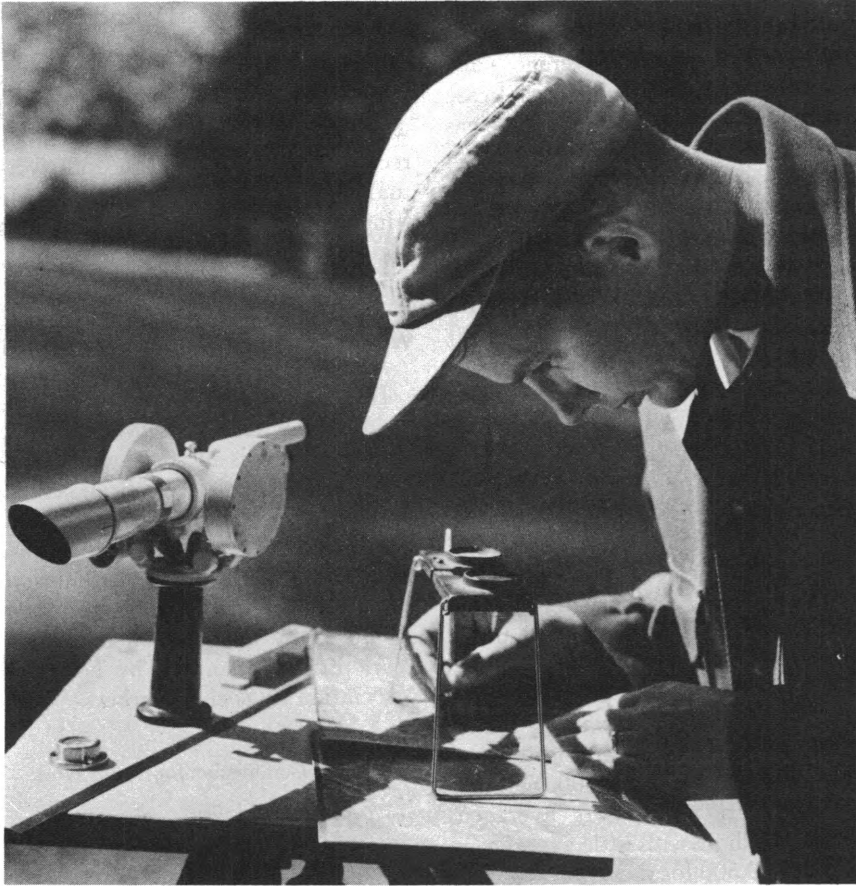
### SURVEYORS

(D.O.T. 018.168 through .687)

### Nature of Work

Surveyors play an important part in the construction of highways, airfields, bridges, dams, and other structures, by providing information on measurements and physical characteristics of construction sites. They also locate land boundaries, assist in setting land valuations, and collect information for maps, charts, and plats.

The primary task of the surveyor is to determine the precise measurements and locations of elevations, points, lines, and contours on or near the earth's surface, and the distances between points. The surveyor is directly responsible for the survey and its accuracy. He plans the fieldwork, selects survey reference points, and determines the precise location of nat-



Surveyor compares his mapping with aerial photographs.

ural and manmade features of the survey region. He records information disclosed by the survey; makes mathematical calculations based on such information; verifies the accuracy of survey data; and prepares sketches, maps, and reports.

In making his detailed measurements, the surveyor is assisted by workers in a field party which he directs. A typical field party is made up of from three to six members in addition to the surveyor (sometimes called the party chief). Included in the typical field party are *instrumentmen*, who set up, adjust, and operate surveying instruments, including the theodolite, transit, level, altimeter, and electronic measuring devices at the points designated by the surveyor; *chainmen*, who measure distances between points, using a metal tape or surveyor's chain; and *rodmen*, who use a level rod, stadia board, or range

pole to assist in measuring elevations, distances, and directions between selected points.

Surveyors often specialize in one particular type of survey. Those doing *highway surveys* are concerned with establishing the points, grades, and lines needed for highway locations. Those carrying out *land surveys* locate boundaries of a particular tract of land, prepare maps, record plats of the land, and prepare legal descriptions of it for deeds, leases, and other documents. Surveyors engaged in *geodetic surveys* measure immense areas of land, sea, or space, taking into account the earth's curvature and its geophysical characteristics. Surveyors doing *topographic surveys* determine the elevations, depressions, and contours of an area, and indicate the location of distinguishing surface features such as farms, buildings, forests, roads, and rivers. Those who

work on *photogrammetric surveys* apply mathematical techniques to photographs taken from airplanes or ground stations to make topographic maps, and to measure the natural and manmade features of an area. Surveyors also specialize in other types of surveys such as *gravity*, *magnetic*, *hydrographic*, *mine*, *oil-well directional*, *pipeline*, *construction*, or *railroad*.

### Where Employed

It is estimated that over 45,000 surveyors were employed in early 1967; less than 5 percent were women. They were located in all parts of the country—in small towns as well as in large cities.

About one-half of all surveyors work for Federal, State, and local government agencies. Among the Federal Government agencies utilizing these workers are the U.S. Geological Survey and the Bureau of Land Management of the Department of the Interior, U.S. Coast and Geodetic Survey (within the Environmental Science Services Administration) and Bureau of Public Roads of the Department of Commerce, Corps of Engineers of the Department of the Army, and Forest Service of the Department of Agriculture. Surveyors in State and local government agencies are employed mainly by highway departments and by urban planning and redevelopment agencies.

A large number of surveyors work for construction companies and for engineering and architectural consulting firms. A sizable number either work for or head surveying firms which conduct surveys on a fee or contract basis. Other significant numbers work for the crude petroleum and natural gas industries and for utilities.

### Training, Other Qualifications, and Advancement

The most common method of preparing for work as a surveyor is

through a combination of post-secondary school courses in surveying and extensive on-the-job training in survey techniques and in the use of survey instruments. Courses in surveying are offered in extension divisions of many post-secondary schools and by correspondence schools. Some junior colleges, technical institutes, and vocational schools offer 1, 2, and 3-year programs in surveying. The entrance requirement for most surveying programs is high school graduation, preferably including courses in algebra, geometry, trigonometry, calculus, drafting, and mechanical drawing.

For a professional career in the more specialized and technical surveying areas such as geodesy, topography, or photogrammetry, it is usually necessary to obtain a bachelor's degree in engineering or the physical sciences.

High school graduates having no formal training in surveying may also enter the field, usually starting as rodmen. After several years of on-the-job experience and some formal courses in surveying, young persons may advance successively through the positions of chainman and instrumentman to that of party chief or surveyor.

With some post-secondary school courses in surveying, beginners may start as instrumentmen. In many instances, promotion to higher level positions is made on the basis of a written examination, as well as on experience.

About 40 States require licensing or registration of land surveyors responsible for locating and describing land boundaries. In some of these States, applicants for licenses are expected to know other types of surveying in addition to land surveying. Requirements for licensing vary among the States, but in general include a combination of 4 to 8 years' experience in surveying and successful completion of an examination. If an applicant has taken postsecondary school courses related to survey-

ing, most States will reduce the length of experience needed for licensing. In 1966, approximately 16,000 land surveyors were registered. In addition, almost 15,000 engineers were registered to do land surveying, primarily as part of their civil engineering duties; however, these workers are considered engineers rather than surveyors.

In addition to the necessary training and experience, qualifications for success as a surveyor include sound health and a strong liking for outdoor work. Because most surveyors must supervise and direct the work of others, leadership qualities are important also.

### Employment Outlook

Employment opportunities for surveyors are expected to be good through the 1970's. It is anticipated that employment in the field will continue to grow rapidly. In addition to new positions created by growth, about 2,000 openings should result each year from the need to replace those who transfer to other occupations, retire, or die. Prospects will be best for people with postsecondary school training in surveying.

Among the factors expected to contribute to the favorable employment outlook is the rapid growth of urban areas and the enactment of new or revised city zoning laws which will require additional surveyors to locate boundary lines, and to lay out streets, shopping centers, schools, and recreation areas. Construction and improvement of the Nation's roads and highways will require many new surveyors. Furthermore, surveyors with college degrees in geodesy will be needed to help track missiles and spacecraft, and to assist in other space activities.

Employment opportunities for women surveyors will continue to be limited, primarily because much of the surveyor's work is strenuous. A few openings will be available for women with college degrees to make

survey related computations, analyze data, and prepare reports in offices.

### Earnings and Working Conditions

In the Federal Government service, in early 1967, surveyors employed as field party chiefs received starting salaries of \$5,867 or \$6,451 a year, depending on experience. The majority of party chiefs earned between \$6,500 and \$9,000 per year. New college graduates with bachelor's degrees qualifying for Federal Government positions as geodesists began at \$6,387 or \$7,729 a year, depending on their college records. Graduates with bachelor's degrees qualifying for positions in topography and photogrammetry started at \$5,331 or \$6,451 a year. In private industry, according to the limited data available, beginning salaries for surveyors were generally comparable to those offered by the Federal Government but varied somewhat between different areas of the country.

Surveyors usually work an 8-hour day and 5-day week. However, they sometimes work longer hours during the summer months, when weather conditions are most suitable for surveying activities.

The work of surveyors is active and sometimes strenuous. They may stand for long periods, and may walk long distances or climb mountains with heavy packs of instruments and equipment. Because most of their work is done out of doors, surveyors may be exposed to all types of weather conditions. Some duties, such as planning surveys, making photogrammetric measurements, preparing reports and computations, and drawing maps, are usually performed in an office.

### Where To Go for More Information

General information on careers in surveying may be obtained from:

American Congress on Surveying and Mapping, Woodward Building, Washington, D.C. 20005.

Information on the specialty of photogrammetry may be obtained from:

American Society of Photogrammetry, 105 North Virginia Ave., Falls Church, Va. 22044.

## SYSTEMS ANALYSTS

(D.O.T. 033.187, 012.168, 020.081 and 020.088)

### Nature of Work

Systems analysts are concerned with the planning, scheduling, and coordination of activities which are required to develop systems for processing data and obtaining solutions to complex business, scientific, or engineering problems. The methods of systems analysis require that the in-

dividual parts of a problem be viewed within the context of the overall problem. Although a system can be developed to process data manually, mechanically, or with electronic computers, most systems analysts are concerned with developing methods of using computers. (This statement discusses only the work of systems analysts who devise systems which use electronic computers to process data and solve problems.)

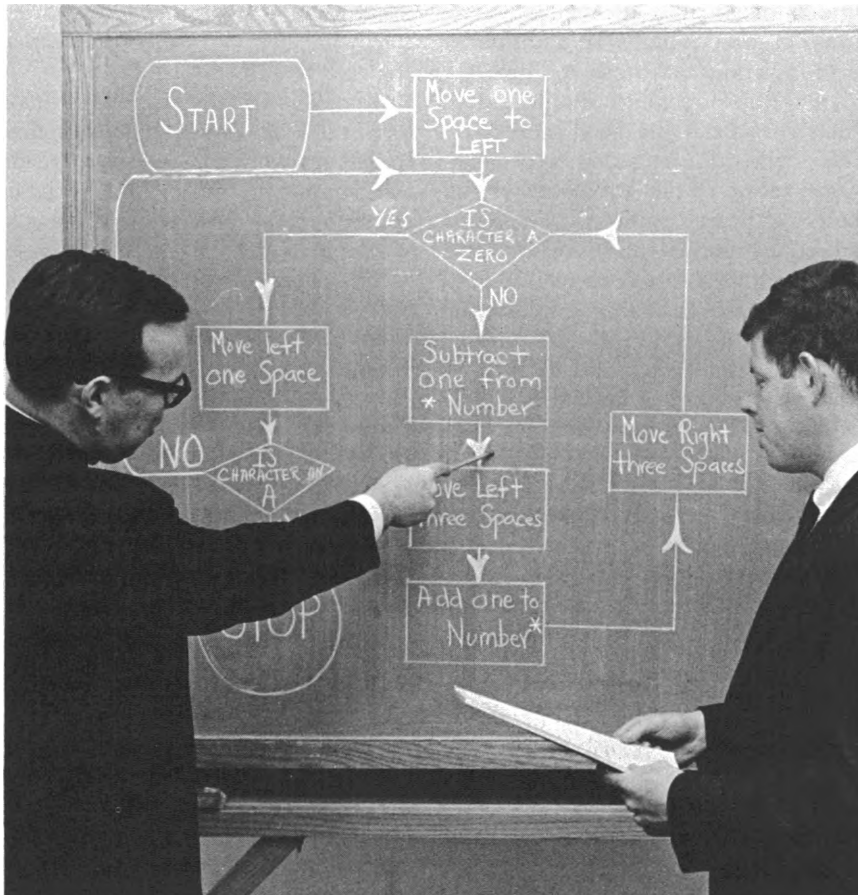
Systems analysts employed by a large business firm may be engaged, for example, in developing methods of processing accounting, inventory, sales, and other business information with electronic computers. With the assistance of managers or subject matter specialists, they determine the exact nature of the data-processing problem. The systems analysts then define, analyze, and structure the

problem in a logical manner so that a system for processing the problem and obtaining the desired results can be developed. They obtain all of the data needed and define exactly the way it is to be processed. They prepare charts, tables, and diagrams to describe the processing system and the steps necessary to make it operate. Systems analysts may use various techniques, such as cost accounting, sampling, and mathematical methods, as tools of analysis. After analyzing the problem and devising a system for processing, systems analysts may recommend the type of equipment to be used and prepare instructions for programmers. They may also interpret final results and translate them into terms which are understandable to management, subject matter specialists, or customers.

The number and types of data-processing problems are so vast and solution processes so varied and complex that many systems analysts tend to concentrate on particular subject matter areas. For example, in business offices, analysts may specialize in accounting or inventory control. Systems analysts who work on scientific or engineering problems may specialize in problems, such as the determination of the flight path of space vehicles. Other analysts may develop systems for planning and forecasting purposes, such as systems used in sales or marketing research.

Systems analysts also improve operating systems and develop entirely new data-processing methods and applications. When working with systems already in use they are concerned with improving and adapting the system to handle additional or different types of data. Analysts engaged in research are concerned with finding or devising new techniques and methods of systems analysis. Often this work is described as "advanced" systems design and analysts engaged in this type of activity usually have mathematical, scientific, or engineering backgrounds.

Some systems analysts have managerial and administrative duties.





They are responsible for overall systems design and feasibility, and for assigning analysts to various phases of a project. They may also plan, organize, and control systems analysis throughout the organization in which they are employed and prepare reports of their work.

### Where Employed

More than 60,000 persons were estimated to be employed as systems analysts in mid-1966. They work mainly for insurance companies, manufacturing concerns, banks, wholesale and retail businesses, and the Federal Government. A growing number of systems analysts are employed by universities and independent service organizations which furnish computer services on a fee basis to business firms and other organizations. Systems analysts work mainly in large cities.

### Training, Qualifications, and Advancement

There is no universally acceptable way of preparing for work in systems analysis. Some employers prefer that candidates have a college degree as well as experience in mathematics, science, engineering, accounting, or business. Their educational preparation and experience often determine the kinds of job opportunities available to them. For example, employers are likely to seek a systems analyst who has a background in business administration to work in finance or similar systems areas; those with an engineering background are likely to be sought for engineering or scientifically oriented systems. Other employers stress a graduate degree. Yet, workers may qualify for work solely on professional experience obtained in scientific, technical, or managerial occupations, or practical experience in such data-processing jobs as computer operator or programmer.

Most employers prefer to hire people who have had some experience

in computer programming. A young person can learn to use electronic data-processing equipment on the job or can take special courses offered by colleges, computer manufacturers, or their employers. In the Federal Government, for example, systems analysts usually begin their careers as programmers. After gaining some experience, they may be promoted to systems analyst trainee where they may qualify as a systems analyst.

In large electronic data-processing departments, a person who begins as a junior systems analyst may be promoted to a position of greater responsibility as he gains experience. Responsible positions in this field include those of senior or lead systems analyst. Systems analysts with proved leadership ability can also advance to manager of systems analysis, electronic data-processing department manager, or other managerial positions.

### Employment Outlook

Employment opportunities for systems analysts are expected to be excellent for the remainder of the 1960's and throughout the 1970's. Systems analysts ranked among the fastest growing professional occupations in recent years. Employers have been experiencing difficulty in recruiting qualified systems analysts because of competing demands from other fields for people with similar backgrounds, especially in science and mathematics.

A growing demand for systems analysts results from the rapid expansion taking place in the number of electronic data-processing systems used by businesses, government agencies, and other organizations. In addition, more opportunities for systems analysts will arise as computers and peripheral equipment become more sophisticated, and are made capable of solving more complex problems in a wider variety of fields. Greater emphasis will be placed on developing computer systems which will retrieve information more efficiently

and economically; solve complex business, scientific, and engineering problems; and monitor and control industrial processes. These developments and others such as the extension of computer technology to small businesses, the use of systems analysis in market research and in determining the locations of plants and stores, and the growth of computer centers to serve individual clients on a fee basis portend a very rapid rise in future employment levels of systems analysts.

In addition to the many employment opportunities resulting from growth in the field, some openings will occur as systems analysts advance to more responsible positions or leave their jobs to enter other types of employment. Because many of the workers are young, relatively few positions will occur because of retirement or death.

### Earnings and Working Conditions

In 1966, beginning salaries of systems analysts averaged between \$7,000 and \$8,000 per year and almost \$15,000 for experienced analysts, according to a private survey which covered more than 2,000 business, government, and educational data-processing installations in all parts of the country. In some cases, experienced systems analysts earned \$25,000 or more a year.

The great majority of systems analysts employed by the Federal Government in early 1967 earned from \$7,696 to approximately \$12,900 a year. Top salaries for experienced systems analysts ranged up to about \$16,905 per year, although top managerial positions pay even higher salaries.

The workweek for systems analysts is usually the same—about 40 hours—as for other professional and office workers. Unlike many computer-oriented workers, such as console operators who work on two or three shifts, systems analysts usually work only during the day. Occasionally, evening or weekend work may

be necessary to complete emergency or rush projects.

### Where To Go for More Information

Additional information about the occupation of system analyst may be obtained from the following sources:

American Federation of Information Processing Societies, 211 East 43d St., New York, N.Y. 10017.

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

A list of reading materials on career opportunities in the data processing field may be obtained from:

Association for Computing Machinery, 211 East 43d St., New York, N.Y. 10017.

## URBAN PLANNERS

(D.O.T. 199.168)

### Nature of Work

City dwellers today face a growing number of typically urban problems such as deteriorating business and residential areas, traffic congestion, inadequate parks and recreation facilities, shortages of suitable space for industrial development, and air pollution. Suburbanites, in addition to sharing some of these problems, also face greater traveling distances between home and work. Professional urban planners try to remedy these problems by developing comprehensive plans and programs for the overall growth and improvement of urban communities.

A community's policies and goals for development are determined by its elected governing body. The urban planner analyzes alternatives and proposes methods for achieving an efficient and attractive community within the framework of these goals. Urban planners visualize future conditions in light of the trends in pop-

ulation growth and social and economic change; they also estimate the community's long-range needs for land, housing, community facilities, transportation, recreation, business, and industry.

Before they can produce plans for long-range community development, however, urban planners must make detailed studies, including the preparation of maps and charts, which show the current use of land for residential, business, and community purposes; the arrangement of streets, highways, and water and sewer lines; and the location of such community facilities as schools, libraries, and playgrounds. These studies also provide information on the types of industry in the community, population densities and characteristics, social features, income levels, employment and economic trends, and other related information.

After they have analyzed and evaluated the facts, urban planners may then design the layout of recommended facilities and land use and supervise the preparation of illustrative materials. They also prepare plans to show how their proposed programs can best be carried out and what the cost is likely to be. Much of their time is spent conferring with officials of public agencies who do specialized planning, with private land developers, and with civic leaders. They also may prepare materials for community relations programs, speak at civic meetings, and appear before legislative councils and committees to explain and defend their recommendations or proposals.

In small planning organizations with only one or two professional workers, the planners must be able to handle several kinds of work. In large organizations, which may have several dozen planners, each may specialize in an area such as physical design, survey and research, or community relations work. Some specialize in new town planning or the rehabilitation of city slum areas and the reconstruction of rundown business districts.

### Where Employed

About 6,500 people were employed as professional urban planners in early 1967, according to an estimate made by the American Institute of Planners. The majority of urban planners are employed by government agencies, mainly city, county, and metropolitan regional planning organizations; some are employed by various State governments and by the Federal Government. About one-fourth of the planners do consulting work, either independently in addition to their full-time job, or as an employee or partner in a private consulting firm providing services for private developers or for government agencies. Urban planners also work for large land developers or private research organizations, and a few teach in colleges or universities.

### Training, Other Qualifications, and Advancement

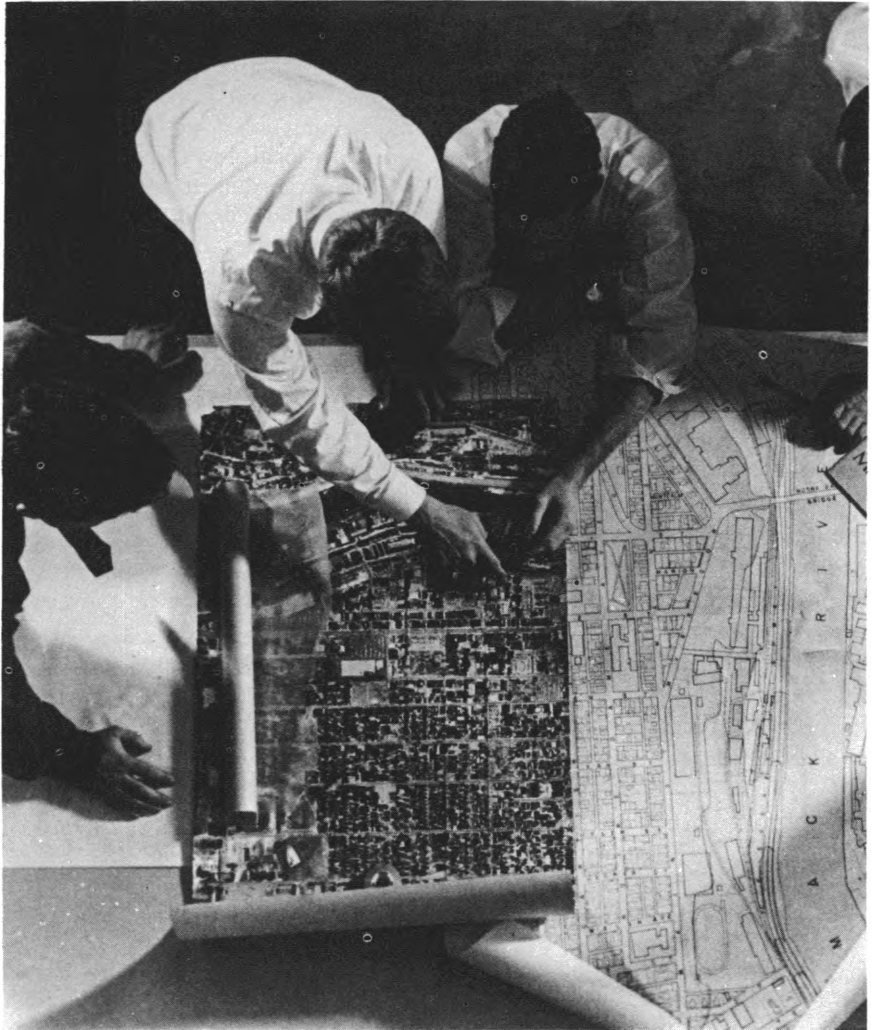
Employers consider a master's degree in planning the most desirable educational background for professional work in this field. In Federal agencies, and in a growing number of other government agencies, 2 years of graduate work in city planning, or the equivalent, is required for most entrance level positions. However, young people with bachelor's degrees in city planning, architecture, landscape architecture, engineering, public administration, and some other social science fields may also qualify for entrance level positions.

In early 1967, more than 40 colleges and universities awarded the master's degree in planning. For entrance into the programs, most schools require that students have undergraduate degrees in fields such as architecture, landscape architecture, engineering, economics, statistics, sociology, public administration, or city and regional planning. Nearly all schools require students to spend considerable time in workshop, laboratory, or studio courses, learning to analyze and solve practical problems

in urban planning. Most schools require candidates for the master's degree to take 2 years of graduate work and to prepare a thesis or take a final comprehensive examination. A few schools have recently adopted a 3-year master's degree program. Nearly half of the schools require some practical experience or internship. This latter requirement is usually fulfilled by regular paid employment during summer months in a planning office approved by the school's faculty. A few schools which stress physical design grant a master's degree on completion of 1 year of graduate work to students who hold a bachelor's degree in architecture or engineering.

Planners must have the ability to think in terms of spatial relationships and to visualize the effects of their plans and designs. They also must be able to get along well with people and appreciate a wide variety of attitudes and viewpoints. On occasion, they face the discouragement of seeing carefully designed plans fall through because of conflicting interests or apathy. In addition, they must be able to write and speak persuasively. It is also important that they continue their professional studies in order to broaden their knowledge and keep abreast of new developments.

Beginners in urban planning offices are likely to spend some time drafting, operating a calculating machine, or making field surveys and compiling statistics required to make projections for future plans. As they become more experienced, workers may be assigned to outline proposed studies, write reports, design the physical layout of a large development, make statistical analyses and projections, or perform other duties which require a high degree of independent judgment. When they become senior planners and planning directors, urban planners are likely to spend much time in meeting with officials in other organizations, addressing civic groups, and supervising other professionals. Advancement often occurs through a move to a



Urban planners discuss land use proposal.

larger city, where the problems are more complex and the responsibilities for planning are greater.

Candidates for the position of urban planner in Federal, State, and local government agencies frequently must pass civil service examinations to become eligible for appointment. These examinations are often advertised nationally and usually do not impose residence restrictions.

### Employment Outlook

Employment opportunities for graduates with professional training in city and regional planning are ex-

pected to continue to be very good through the 1970's. Shortages of qualified planners have been reported in recent years, even though the number of graduates has been rising. In 1966, the American Society of Planning Officials estimated that there were about 1,500 vacancies in planning agencies because of the shortage of well-qualified planners. Although most of these vacancies stemmed from the need to fill new planning positions, some also resulted because planners transferred to other fields of work, retired, or left the field for other reasons.

The demand for city planners is expected to continue to rise over the

long run. More communities will probably turn to professional planners for help in determining the most effective way to meet the rising requirements for physical facilities that result from urbanization and growth in population. As urban communities continue to spill into neighboring areas or merge with other urban areas, open spaces for recreation disappear, smog and traffic problems multiply, and the need for more and better planned facilities becomes more acute.

Federal programs of financial assistance to communities for urban planning, for slum clearance and urban renewal, for beautification and open space land improvement, and for improvement of other local facilities will continue to stimulate the demand for planners. The construction of completely new cities and towns is also expected to contribute to a rising need for planners.

### Earnings and Working Conditions

Starting salaries of inexperienced planners without a graduate degree in planning averaged about \$6,500 a year in local government agencies in 1966, according to a study by the American Society of Planning Officials. Entrance salaries for qualified beginners with a master's degree in planning were generally between \$7,500 and \$9,000 a year. Average salaries of planning directors ranged from about \$10,000 a year in small cities to over \$22,000 in cities with a population of a million or more. Consultants are generally paid on a fee basis. Their earnings are often high and vary greatly according to their reputation and previous work experience.

The usual entrance salary in the Federal Government was \$7,696 a year in early 1967. In a few cases, individuals with less than 2 years of graduate work or its equivalent were

hired as interns at yearly salaries of \$5,331 or \$6,451, depending upon their academic records.

Since most planners work for government agencies, they usually have sick leave and vacation privileges, and are covered by retirement and health plans. Although most city planners have a scheduled workweek of 40 hours, they sometimes work in the evenings and on weekends because of the need to attend meetings with citizen's groups.

### Where To Go for More Information

Additional information on planning may be obtained from:

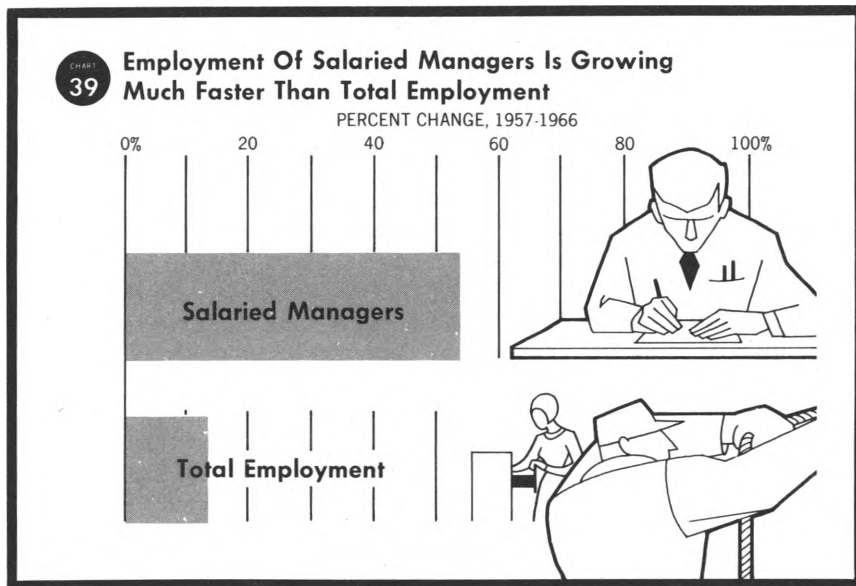
American Institute of Planners,  
917 15th St. NW., Washington, D.C.  
20005.

American Society of Planning Officials,  
1313 East 60th St., Chicago, Ill.  
60637.

## MANAGERIAL OCCUPATIONS

The success or failure of business enterprises probably depends more on the way managers do their job than on anything else. Nearly 4.7 million salaried workers—85 percent of whom were men—were employed in 1966 to manage the business activities of our Nation's enterprises. An additional 2.7 million were self-employed who carried on all or part of the activities necessary for the management of their own businesses. In addition, many professional workers also have managerial responsibilities. Business managers are one of the fastest growing occupational groups in the country. Between 1957 and 1966, the number of salaried management workers increased nearly four times as fast as all workers. (See chart 39.)

This chapter describes salaried managers as a group, and presents individual statements on two such occupations—industrial traffic managers and purchasing agents. Statements on related business administration occupations are presented elsewhere in the *Handbook*.



### Nature of Work

Salaried managers usually have one prime aim: to get a job done by directing or planning the work of others. Some, however, are chiefly policymakers. Managers' responsibilities depend on the management level and type of employer.

First-level management positions are either supervisory or trainee. Supervisors, the largest group, direct workers in activities such as sales, research, production, accounting, and purchasing. A department manager in a retail department store, for example, has a typical supervisory job. Responsible for merchandising in one

department or more, he may supervise up to 50 employees or more. Manager trainees, also in the first management level, are sometimes assigned as assistants to managers; or they may be placed for short periods in a number of different jobs in one or more departments in order to learn several phases of the business.

Higher in the managerial pyramid are the middle-level managers; they have the top posts in such large and important departments as sales, accounting, marketing, production, purchasing, and personnel. When faced with nonroutine business problems, they must make decisions promptly within the framework of company policy. The manager of a manufacturing company's engineering department, for example, may (1) develop policies and plans for making efficient use of the firm's space and facilities—with proper followup; (2) assist the engineer in carrying out the company's safety program; (3) set up and manage support services (for example, maintenance of equipment, buildings, and grounds).

Top level managers make decisions on what products their firms should develop and produce in the years ahead, whether and where new plants should be built, and how to finance them. This top group includes the board of directors, the vice president, and the president or chairman of the board of directors. Each vice president is responsible generally for efficient operation of one or more company departments (for example, finance, marketing and sales, or production). He is a policymaker and administrator in his own area, and reports directly to the president. The president or the chairman of the board has the final responsibility for the company's successful operation. He usually presides at periodic meetings with his officers, conferring with them not only on matters in their own areas of responsibility, but getting their help in solving company-wide problems.

Management responsibilities in government are similar to those in private industry. However, a major responsibility of many managers is service to the public.

### Where Employed

Managers are employed in all industries but more are required in some industries than in others. Retail and wholesale trade, for instance, accounted for nearly one-third of all salaried managers employed in private industry and government in 1966. About one-fifth had jobs in manufacturing firms. Establishments in the following areas also employed considerable numbers: Finance, insurance, real estate, services, transportation, and public utilities. Government workers in managerial jobs made up about one-tenth of all salaried managers. Women find their best opportunities in retail trade; 4 in every 10 women managers are employed in this field.

### Training and Advancement

Employers increasingly are requiring beginning managers to have completed college. Although it is possible for an able person who doesn't have a degree to work his way up through the ranks, his promotional opportunities may be limited.

For beginning management jobs, many employers look for individuals who have a college degree in business administration, with a major in accounting, economics, or finance. Other employers look for applicants who have technical training in engineering, science, or mathematics that will be useful in dealing with technically complex industrial processes. Still others hire graduates holding liberal arts degrees and give them training on the job.

The number of companies with formal management trainee programs, is relatively small. As a result, entrance to management jobs is more likely to come after several years of

progressively more responsible work experience in jobs such as salesman, accountant, or engineer.

The climb up the promotional ladder may be in one area of work, such as finance, or in several areas, such as shifts from personnel to finance to production. Managerial skills can usually be applied as effectively in one firm or industry as another. For this reason, managers are able to change jobs with relative ease.

To increase their knowledge of management techniques, many experienced managers take advantage of training programs given by colleges and universities, companies, and various professional and trade organizations. Management associations, for example, conduct educational programs for experienced managers ranging from lectures and workshops lasting a few days to formal classroom courses lasting several weeks. These educational activities are usually led by experienced businessmen.

### Employment Outlook

Management career opportunities should be good through the 1970's. Employment of managers is expected to grow rapidly through the 1970's; moreover, many thousands of openings are expected to result annually from the need to replace people who retire, die, or leave the field for other reasons.

It is anticipated that the business world will need more managers as industries continue to expand, spurred by a growing population whose rising living standards will create an increasing demand for goods and services. The employment of salaried managers is likely to continue to increase rapidly because of the greater dependence on trained management specialists by large firms as they grow larger. Their problems of control and communication, their need for specialized services, and their complex machinery demand a higher ratio of managers to total employees than do the small firms. Government, reacting to similar influences, will also need

more managers. In addition, technological advances creating new products and even new industries are expected to increase demand for management-related occupations for young people having specialized skills in computer technology and other areas.

### Earnings and Working Conditions

Starting salaries for management trainees with bachelor's degrees generally ranged, in private industry, from about \$6,000 to \$7,200 a year in early 1967. Persons with bachelor's degrees entering managerial work in the Federal Government had starting salaries of \$5,331 or \$6,451 a year. Trainees with master's degrees in private industry generally began at higher salaries; starting salaries ranged from about \$8,300 to \$9,600 a year. In the Federal Government, new employees with master's degrees entered managerial work at salaries of \$6,451 or, if especially well qualified, \$7,696 a year.

At higher management levels, salaries are related to company size and the nature of the industry. Middle-management salaries ranged from about \$10,000 to \$25,000 a year in 1967. Very large companies paid salaries up to \$50,000 a year in some middle-management positions. Top executives' earnings, usually the president's averaged about \$45,000 in small companies, but in large corporations were as high as \$200,000 a year or more.

In addition to their salaries, high-ranking management officials receive other compensation, such as bonuses, stock options, and participation in profit sharing plans. Additional compensation depends to a considerable extent on a company's profits. Bonuses are a common type of extra compensation and generally average about 45 percent of executive earnings. Many companies also provide liberal life insurance, health benefits, club memberships, and various special privileges according to the individual's

position in the firm. Social prestige attained in the upper business levels also may be rewarding.

First-level managers usually work the standard workweek of the company—from 35 to 40 hours a week. In more responsible jobs, they carry heavier workloads and may work longer hours. Nonroutine assignments carried out on their own time may involve travel, nightwork, speaking engagements, and other activities.

### Where To Go for More Information

The American Management Association,  
135 West 50th St., New York, N.Y.  
10015

The Society for the Advancement of Management,  
16 West 40th St., New York, N.Y.  
10015

## INDUSTRIAL TRAFFIC MANAGERS

(D.O.T. 184.168)

### Nature of Work

Determining the best way to move freight about the country or around the world can be a complicated matter. There is piggyback and air freight, as well as regular rail, truck, and steamship; and there are thousands of freight classifications, rates, routes, and regulations. Trained specialists called industrial traffic managers are responsible for handling this job.

Industrial traffic managers and their assistants arrange for transportation of raw materials and finished products to and from industrial and commercial firms. They see that goods are shipped in a way that will ensure prompt and safe delivery at the lowest possible cost.

After taking into consideration the kind and amount of goods to be shipped, the time when delivery is needed, and other factors, they choose the type of transportation, the

route, and finally the particular carrier, or transportation company. (Traffic managers employed by railroads, airlines, trucking firms, and other transportation companies, who are chiefly concerned with attracting business to their firms, are not covered by this statement.)

The duties of industrial traffic managers range from routine tasks, such as checking freight bills, to major planning and policymaking matters, such as deciding whether the company should buy and operate its own fleet of trucks. Other duties include ascertaining the freight classifications and rates that apply to goods shipped, routing and tracing shipments, arranging with carriers for transportation services, preparing bills of lading and other shipping documents, and handling claims for lost or damaged goods. In addition, traffic managers are responsible for maintaining records not only of shipments but also of freight rates, commodity classifications, and applicable government regulations. Sometimes traffic managers are responsible for the packaging of shipments and for their companies' warehouse facilities and transportation equipment.

In small companies, or in firms without separate traffic departments, transportation arrangements for incoming goods may be made by the purchasing department, and for outgoing goods, by the sales department. Employees who handle transportation arrangements in such firms must have a broad knowledge of the transportation field, but usually they do not have the title "traffic manager."

Since many aspects of transportation are subject to Federal, State, and local government regulations, traffic managers must know about these and any other legal matters that apply to their companies' shipping operations. Many traffic managers represent their companies before rate-making and regulatory bodies—such as the Interstate Commerce Commission, State Commissions, and local traffic bureaus—to request or oppose



Industrial traffic managers study distribution system.

changes in rates, commodity classifications, or types of service provided by carriers.

### Where Employed

An estimated 15,000 people held jobs as industrial traffic managers in 1967. The majority were employed by manufacturing firms, although some worked for stores and other types of establishments. A few traffic managers are in business for themselves, acting as consultants on transportation problems for various clients. Most traffic managers are men.

### Training, Other Qualifications, and Advancement

Although it is still possible for those having only a high school education to qualify for traffic manager positions on the basis of experience in traffic departments, a college education is becoming increasingly important for a career in this field. For some kinds of work, college training may be required. For example, in order to argue cases before the U.S. Government's Interstate Commerce Commission, a traffic manager must meet certain "qualification standards" which generally include at least

2 years of college training. In selecting college graduates for trainee positions, some employers prefer to hire graduates of schools of business administration who have majored in transportation; others prefer holders of degrees in liberal arts who have had courses in transportation, management, economics, statistics, marketing, or commercial law.

The first jobs of new traffic department employees are often in shipping rooms, where they gain experience in routing shipments and preparing bills of lading and other shipping forms, or in general traffic offices, where they may do clerical work such as filing schedules of freight rates and calculating freight charges. After gaining experience in various routine tasks, employees may be advanced to more technical work such as analyzing rates and transportation statistics. After further experience, a competent worker may advance to a supervisory position, such as supervisor of rates and routes. For the most competent, promotion to assistant manager, and eventually to manager, is possible.

Workers in traffic departments may prepare themselves for advancement by participating in company-sponsored training programs, by taking courses in colleges, universities, and vocational schools, or by attending seminars sponsored by various private organizations. A mark of professional status and recognition in traffic management work is "certified" membership in the American Society of Traffic and Transportation, Inc., which can be acquired by successfully completing the Society's examinations and meeting certain education and experience requirements.

### Employment Outlook

A steady increase in employment in this occupation can be expected through the 1970's. Some large companies will probably follow the example already set by many corporations and reorganize their ship-



ping and receiving activities into separate traffic departments with traffic managers in charge. In other companies, new transportation jobs will probably be located in purchasing or sales departments and thus have different job titles.

Among the factors expected to contribute to the growth in this field are the increasing emphasis in many industries on efficient management of transportation activities and the trend toward procuring raw materials and finished products from more and more remote places and distributing them to increasingly wider markets. Since transportation costs are a major factor in the price of many items, companies are becoming increasingly concerned about economies in shipping. A strong demand is expected for specialists who know how to classify products so as to obtain the lowest possible freight rates, choose the carriers that are best able to handle each shipment, and otherwise protect their companies from excessive shipping expenses.

### Earnings and Working Conditions

Young men having college degrees who started as business trainees in the traffic departments of large industrial firms often received annual salaries of about \$6,900 in 1967, according to the limited data available. Beginners having less schooling, however, usually received lower salaries.

Earnings of experienced traffic managers are related generally to their companies' sales volume and transportation costs. The average (median) salary of traffic managers in companies with transportation costs totaling less than \$1 million annually was about \$10,000 in 1967 according to the limited information available. In companies where transportation costs ranged between \$4 million and \$10 million, annual salaries generally range between \$17,500 and \$20,000. In firms where these costs were still higher, some traffic executives earned considerably more than \$25,000.

Traffic department employees usually work the standard workweek of their companies—generally from 35 to 40 hours. Those in particularly responsible jobs may have to spend some time outside regular working hours preparing reports, attending meetings, and traveling to hearings before State and Federal regulatory agencies.

### Where To Go for More Information

For information on the requirements for certification by the American Society of Traffic and Transportation, Inc., write to:

American Society of Traffic and Transportation, Inc.,  
22 West Madison St., Chicago, Ill.  
60602.

## PURCHASING AGENTS

(D.O.T. 162.158)

### Nature of Work

In order for a company or other organization to function, it has to purchase materials, supplies, and equipment. Such necessities often represent a large part of total costs of operation and can significantly affect a company's profits. Because of its importance, purchasing has been designated as a separate responsibility to be handled by one of the management teams—the purchasing agent.

What purchasing agents and their assistants buy depends upon the kinds of organizations employing them. For manufacturers, it may be largely machinery, raw materials, and product components; for government agencies, it may be office supplies, office furniture, and business machines. Whatever the organization, purchasing agents are responsible for obtaining goods and services at the lowest cost consistent with required quality and for seeing that adequate supplies are on hand.

Although the head of the purchasing department is usually called a

purchasing agent, he may have the title of vice president–purchasing, procurement or purchasing officer, director or manager of purchasing, or buyer. (“Buyers” in retail stores, and others who are engaged in buying merchandise for resale in its original form are not included in this report.) In a large firm, the head of the purchasing department directs the work of a staff including assistant purchasing agents and clerical workers. Each purchasing assistant may be assigned to a broad area. One person may be responsible for buying raw materials; another, factory machinery; and another, office supplies. Others may specialize in buying certain items—for example, steel, lumber, cotton, or oil.

The purchasing agent receives order forms or requisitions from the various departments of the company. These requisitions list and describe needed items and include information such as required quantities and delivery dates. Since the agent can usually purchase from many sources, his main job is to select the seller who offers the best value. To do this, the agent must consider many factors, such as the exact specifications for the required items, price, quality, quantity discounts, transportation cost, and delivery time. Much of the information is obtained by comparing listings in catalogs and trade journals and by telephoning various suppliers, but the purchasing agent also meets with salesmen to examine sample goods, watch demonstrations of equipment, and discuss items to be purchased. Sometimes, suppliers are invited to bid on large orders, and the purchasing agent selects the lowest bidder who meets requirements with respect to the specifications set up for the goods and date of delivery.

It is important for purchasing agents to develop good working relations with their suppliers. Such relations can result in savings on purchases, favorable terms of payment, and quick delivery on rush orders or material in short supply. They also work closely with personnel in various departments of their own company.



Before buying parts, purchasing agent discusses new product design with other staff members.

For example, they frequently discuss product specifications with company engineers or discuss shipment handling problems with employees in the shipping and receiving, storage, or traffic departments.

### Where Employed

More than half of the estimated 150,000 purchasing agents and closely related types of buyers employed in 1967 were in manufacturing industries. Large numbers were employed in government agencies—Federal, State, and local—and in wholesale and retail trade. Public utilities, transportation companies, and service institutions, such as schools and hospitals, employed substantial numbers of purchasing agents and assistants. Even the smallest industries employed some purchasing personnel.

Most purchasing agents work in firms that have fewer than 10 employees in the purchasing department. Some large firms, however, may have a hundred specialized buyers or more. About 10 percent of all purchasing agents are women.

### Training, Other Qualifications, and Advancement

Many employers prefer to hire graduates of schools of business administration or engineering who have had courses in accounting, economics, and purchasing for beginning positions as purchasing agents. A few require graduate training in business administration. On the other hand, many firms give great weight to experience with the company and select purchasing workers from among their own personnel, whether or not they have a college education. For

advancement to high-level positions, however, a college degree is becoming increasingly important.

Regardless of previous training and experience, the beginner in the purchasing field must spend considerable time learning about his company's operations and purchasing procedures. Some companies provide classroom-type instruction and on-the-job training. The beginner may be assigned to the storekeeper's section to learn about operations such as keeping inventory records, filling out forms to initiate purchases of additional stock, or providing proper storage facilities. He may then work with an experienced buyer to learn about types of goods purchased, prices, and sources of supply. Following the initial training period, the trainee may become a junior buyer of standard catalog items. After he gains experience in the various aspects of purchasing and demonstrates ability to exercise good judgment and accept responsibility, he may be promoted to assistant purchasing agent, and then to full-fledged purchasing agent. In large companies, purchasing agents or heads of purchasing departments may become vice presidents with overall responsibility for purchasing, warehousing, traffic, and related functions.

### Employment Outlook

Opportunities are expected to be very good through the 1970's for young people to enter and advance in purchasing occupations. Demand is expected to be especially strong for graduates of schools of business administration who have had courses in purchasing. Demand also is expected to be excellent for graduates whose background in engineering and science qualifies them for jobs in purchasing departments of firms that manufacture complex machinery, chemicals, and other technical products. Liberal arts college graduates should be able to obtain trainee positions in many types of firms. Out-

standing persons who do not have a college education will continue to be promoted from clerical, sales, and other types of jobs, but their opportunities for advancement to high-level purchasing jobs will be limited.

Employment of purchasing agents and their assistants is expected to grow rapidly through the 1970's. Some of the major factors underlying this expected growth are the continuing increase in the size of business and manufacturing firms, the development of new products and new sources of supply (including foreign markets), and the ever-increasing complexity and specialization of business functions. Competition among manufacturers for new, improved, and less costly goods, raw materials, and services will further direct the attention of top management to the importance of the purchasing function. In addition to job openings re-

sulting from growth, many job opportunities are expected because of the need to replace personnel who retire, transfer to other jobs, or leave the field for other reasons.

### **Earnings and Working Conditions**

Beginning annual salaries of male college graduates hired as trainees in purchasing departments of large private firms ranged between \$5,500 and \$6,500 in 1967 according to the limited data available. In the Federal Government, beginning purchasing agents who had college degrees started at \$5,331 or \$6,451 in early 1967 depending on the individual's college record.

The annual earnings of buyers in private firms, in 1967, ranged from \$7,000 to \$8,500; assistant purchasing agents ranged from \$8,500 to

\$12,000; and purchasing agents, from \$12,000 to \$20,000. Some top purchasing executives earned from \$25,000 to \$50,000.

Employees in purchasing departments usually work the standard workweek of the company—generally from 35 to 40 hours a week. In addition, purchasing agents may spend time outside the regular hours to attend meetings, prepare reports, visit suppliers' plants, or travel.

### **Where To Go for More Information**

Young people interested in a career in purchasing may consult members of local purchasing associations, or they may write to:

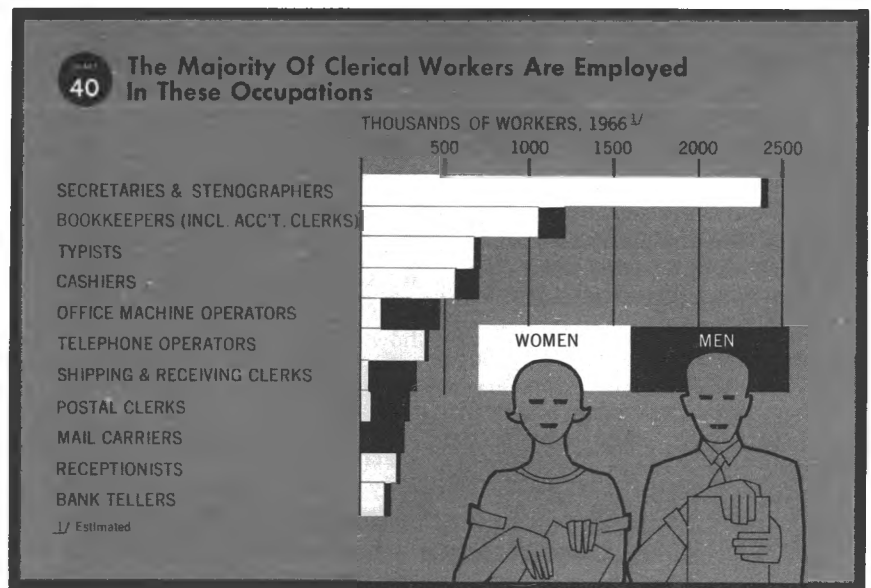
National Association of Purchasing Agents, 11 Park Pl., New York, N.Y. 10007.



## CLERICAL AND RELATED OCCUPATIONS

Almost 12 million people were employed in clerical or some closely related kind of work in early 1966. A great many of these workers keep records and do other paperwork required in present-day offices. Others handle communications through mail, telephone, telegraph, and messenger services; attend to the shipping and receiving of merchandise; ring up sales on the cash registers of stores and restaurants; or do related work.

Clerical workers represent a wide variety of skills and experience. Included, for example, are title searchers and examiners in real estate firms, and executive secretaries in business offices, as well as workers in occupations which can be entered with little specialized training or experience—messengers, file clerks, and others. For women, clerical occupations are a particularly large field of employment. More than half of all girls who go to work after completing high school find jobs in clerical and related



occupations; and 7 out of 10 clerical workers are women.

By far the largest single group of clerical workers—1 out of 5—work as secretaries or stenographers. Bookkeepers and accounting clerks, who

represent a little more than one-tenth of the total, make up the next largest group. Chart 40 shows employment in these and in other major clerical occupations discussed in this chapter or elsewhere in the *Handbook*.



### Training, Other Qualifications, and Advancement

For all but the most routine clerical positions, the minimum educational requirement is usually graduation from high school. High school graduates who have had instruction in business subjects are regarded by most employers as particularly well qualified. Some companies cooperate with local high schools and business schools in office education programs which provide opportunities for students to work part time, under trained supervision, while still attending school. This experience is useful to beginners seeking office jobs after graduation. The Federal Government also sponsors training for some clerical occupations under provisions of the Manpower Development and Training Act of 1962. Reading comprehension, a knowledge of spelling and grammar, and ability in arithmetic are impor-

tant for many types of clerical work. Some employers test applicants for clerical aptitude, to ascertain their qualifications for work in this field.

Practically all beginning clerical workers receive some on-the-job training. They learn, for example, how their employer keeps the firm's records, and what kinds of business forms are used. They may also learn to operate adding and duplicating machines and other equipment which they will use occasionally. If they are to operate tabulating machines or other specialized equipment, their employers may have them attend a school to receive the necessary training.

Many types of clerical work offer good prospects for advancement. Some of the better paid positions—insurance claim adjuster and executive secretary, for example—require a general knowledge of company policies and procedures, and are very

often filled by promotion from within. In other instances, promotion may be to more difficult and higher paid assignments in a related type of work, as in the case of a keypunch operator who is selected and trained to operate a tabulating machine. In large business offices, promotion may eventually lead to supervisory or managerial positions.

Experience within an organization is often an important consideration in selecting employees for promotion. Emphasis is also placed on the individual's training, ability, and personal qualifications. For workers without a good educational background, opportunities for advancement are likely to be limited. Many people in clerical occupations are high school graduates who have some additional education in colleges, junior colleges, private business schools or other post-secondary institutions. Some are college graduates, who start as office workers to gain experience which will later qualify them for professional or administrative positions.

### Employment Outlook

Employment in clerical occupations is expected to rise moderately during the rest of the 1960's and through the 1970's. As employment rises to meet the needs of an expanding economy, more than 325,000 new positions in clerical and related occupations will be added each year. An even greater number of clerical workers will be needed each year to replace those who retire or leave their job for other reasons. Employee turnover is especially high among clerical workers because many young women do this kind of work for only a few years and then leave their jobs to remain at home and care for their families.

Employment opportunities will be particularly numerous for workers who handle paperwork in the offices of private and public organizations—for secretaries and stenographers, typists, and bookkeeping and accounting clerks, for example. These

workers will be needed particularly in banks and insurance companies; in manufacturing establishments and in wholesale and retail trade; and in government offices, educational institutions, and professional service organizations.

The number of clerical and related jobs is expected to increase mainly because the volume of paperwork will undoubtedly expand as business organizations grow in size and complexity. On the other hand more and more mechanical equipment will speed the process of keeping business records, particularly in large cities, and in some of these offices, the number of clerical employees may be reduced. For the economy as a whole, however, the new positions created by growth are expected to far outnumber the clerical jobs eliminated by mechanization. Furthermore, many types of clerical workers are in jobs unlikely to be materially affected by mechanization—for example, secretaries, receptionists, people responsible for collecting bills and handling complaints, and others whose duties bring them into contact with the public and require them to exercise initiative and judgment.

Since electronic computers, book-keeping and calculating machines, and other mechanical devices are used in offices mainly to process routine and repetitive work, their use can be expected to bring about reductions in the number of clerks employed to prepare payrolls, keep track of inventories, bill customers, sort checks in banks, and do other routine work. As work of this kind is transferred from clerks to machines, a limited number of new positions for various kinds of machine operators will be created. This shift in type of clerical personnel will occur chiefly in large business firms and in the metropolitan areas where such firms tend to be concentrated.

### Earnings and Working Conditions

The average salaries of women office workers in metropolitan areas

surveyed by the Bureau of Labor Statistics in 1965–66 ranged from \$61.50 a week for file clerks doing the most routine kind of work to about \$112.50 for skilled tabulating machine operators. Within each of the 17 office occupations covered by this survey, the differences in the salaries paid some individuals were considerable; for example, a few routine file clerks earned less than \$40 a week; a few others whose work was complex earned \$100 or more.

Men were generally paid higher salaries than women employed in the same localities. The average for office boys was \$3.00 a week more than for office girls, for example, and men employed as accounting clerks averaged nearly \$20 a week more than women in the same kinds of jobs. To some extent, these differences in the salary levels of men and women were due to differences in the industries where they were employed. Minor differences in the duties and responsibilities assigned to men and women may also affect the level of pay and seniority.

Office employees worked a 40-hour week in most of the cities included in the survey. In some, especially in the northeastern part of the country, the scheduled workweek was 37½ or 35 hours.

Office workers in large cities generally receive pay for 5 holidays or more a year and for 1 or 2 weeks of annual vacation after working 1 year. Longer vacations, granted on the basis of additional years of service, may range up to 4 weeks or more with pay. Life insurance, hospitalization, surgical and medical insurance, and sick benefits are also generally available, as are retirement pension plans supplementing benefits paid under the Federal social security program.

### Where To Go for More Information

Many State employment service offices can provide counselors with occupational guides giving local in-

formation about earnings, hours, and employment opportunities in clerical occupations.

Information about several clerical occupations which are of special interest to girls is contained in the following publication:

*Clerical Occupations for Women, Today and Tomorrow* (Women's Bureau Bulletin 289, 1964). Superintendent of Documents, Washington, D.C. 20402. Price 35 cents.

Teachers may obtain information concerning training for office occupations from:

Office Occupation Unit  
Division of Vocational and Technical Education, Bureau of Adult Vocational and Library Programs  
U.S. Office of Education, Washington, D.C. 20202.

Or by contacting their:

State Supervisor of Office Occupations Education  
State Department of Education  
State Capitol

A directory of private business schools located in 300 cities throughout the country may be obtained from:

United Business Schools Association  
1101 17th St. NW., Washington, D.C. 20036.

Information on wages and related benefits for office workers in 84 metropolitan areas is given in the following publication:

*Wages and Related Benefits, Part I: 84 Metropolitan Areas, 1965–66* (BLS Bulletin 1465–86) October 1966. Superintendent of Documents, Washington, D.C. 20402. Price 55 cents.

Information on wages and related benefit earnings in 212 metropolitan areas is summarized for the northeastern, southern, north central, and western regions, and for the United States as a whole, in the following publication:

*Wages and Related Benefits, Part II: Metropolitan Areas, United States and Regional Summaries, 1965–66* (BLS Bulletin 1465–86) May 1967. Superintendent of Documents, Washington, D.C. 20402. Price 60 cents.



## STENOGRAPHERS AND SECRETARIES

(D.O.T. 201.268 and .368 and 202.388)

### Nature of Work

About 2.4 million persons were employed in occupations requiring stenographic skills in early 1967. More than 95 percent were women. Practically all stenographers and secretaries take dictation and transcribe it on the typewriter. Usually they have additional duties related to the nature of their employer's business; and sometimes they have special job titles which reflect skill levels or job specialties.

*Stenographers* (D.O.T. 202.388) take dictation from one or more persons and then transcribe their notes on a typewriter. Most stenographers record their notes in shorthand; some use machines which print symbols as different keys are pressed. In addition to taking and transcribing dictation,

many stenographers also do other kinds of typing, answer telephones, operate various types of office machines, and perform other clerical duties. Some stenographers, including most beginners, are classified as *general stenographers*; they take fairly routine dictation and perform routine office tasks. Other, more experienced *senior stenographers* have a higher degree of stenographic speed and accuracy, and perform more responsible clerical work. Some senior stenographers, called *technical stenographers*, take dictation in medical, legal, or scientific terms; others take dictation in a foreign language; and still others work as *public stenographers*.

Some stenographers specialize in shorthand reporting. Included in this group are *court reporters*, who record proceedings in law courts. Other *reporting stenographers* record proceedings at business and professional conventions and other meetings; report statements made by officials at press conferences and testimony given

before Government legislative committees; and do other kinds of verbatim reporting. Reporting stenographers take their notes by machine or, less frequently, in written shorthand; and then either transcribe them on the typewriter or dictate them onto sound-producing records which are later transcribed by typists. Stenographers who do this kind of work must be exceptionally rapid and accurate—sometimes taking notes in technical language from many speakers and for extended periods of time.

*Secretaries* (D.O.T. 201.368), in addition to their stenographic work, relieve their employers of numerous routine duties and often handle a variety of business details on their own initiative. Duties vary, depending on the nature of the employer's business activities and also on the secretary's own experience and capabilities. Secretaries often handle such tasks as scheduling appointments for their employers, arranging for airline tickets and hotel reservations, taking care of some kinds of correspondence, and handling private or confidential records. Sometimes they also supervise other clerical personnel. Some secretaries, like stenographers, specialize in legal, medical, or other technical work. Others, who are *social secretaries* (D.O.T. 201.268), make arrangements for social functions, and attend to other personal and social matters for their employers.

### Where Employed

Stenographers and secretaries are employed by public and private organizations of practically every size and type. A few—chiefly public stenographers and some reporting stenographers—are self-employed.

Particularly large numbers of stenographers and secretaries work for manufacturing firms, government agencies, schools and colleges, insurance companies, banks, and hospitals. Many, including technical stenographers and secretaries, are employed in the offices of physicians, attorneys,



and other professional people. Stenographic and secretarial jobs for men tend to be concentrated in educational and other professional services, and in manufacturing and public administration. About three-fifths of the 11,000 stenographers in the United States who specialize in shorthand reporting are men.

**Training, Other Qualifications, and Advancement**

Adequate performance as a stenographer or secretary requires a good basic education as well as technical training. Graduation from high school is essential for practically all positions. Graduates whose high school courses have included shorthand, typing, and possibly other business subjects meet the requirements of many employers. Some employers prefer a background of academic high school subjects, supplemented by technical training taken after graduation.

Daytime and evening courses that prepare students for stenographic and secretarial work are offered by hundreds of public schools, private business schools, and colleges throughout the country. In connection with high school courses in business subjects, some public schools conduct cooperative work-study programs which enable students to acquire practical work experience under trained supervision. Also, the Federal Government sponsors training programs for unemployed and underemployed workers for entry positions as stenographers under provision of the Manpower Development and Training Act. Associate degrees in the field of secretarial studies are conferred by a great number of junior and community colleges. Bachelor's degrees in the field of executive secretary are conferred by the schools of business and commerce in many universities; a few confer the master's degree.

Some courses which train for stenographic work are limited to shorthand and typing, and can be completed in a few months. In other

courses, which are usually of longer duration, students may also be taught additional office skills and receive instruction in general business practices and office conduct. Some courses provide intensive training to prepare students for stenographic reporting or for legal, technical, or medical-dental secretarial work.

The time needed for students to learn shorthand, and the speed they may develop, both depend somewhat on the shorthand system used. There are many different systems—alphabet and symbol systems, as well as machine shorthand—and some are faster than others. Employers seldom have strong preferences about the system a stenographer uses, but they usually regard the rate of speed as an important factor. To qualify for positions in the Federal Government—and for employment in many private firms—stenographers must be able to take dictation at a rate of at least 80 words a minute and type 40 or more words a minute. Speed requirements in some positions may be less than this, however, but in others—particularly in shorthand reporting—much greater. Many shorthand reporting jobs require speeds of 200 or more words a minute. For beginning reporting stenographers in the Federal Government, the minimum is 160 words a minute.

Good hearing and a working knowledge of spelling, punctuation, grammar, and vocabulary are essential in stenographic and secretarial positions. Employers seek workers who are poised, alert, and have attractive personalities. Discretion, good judgment, and initiative are also important, particularly for the more responsible secretarial positions.

Capable and well-trained stenographers and secretaries have excellent opportunities for advancement. Many stenographers advance to better paying positions as secretaries; others, who acquire the necessary speed through experience or additional training, may become reporting stenographers. Both stenographers and secretaries may eventually be promoted to jobs such as administrative

assistant, office supervisor, executive secretary, or some other responsible position requiring specialized knowledge of the employer's industry or business.

**Employment Outlook**

Employment opportunities for workers with stenographic skills are expected to be very good during the rest of the 1960's and through the 1970's. As modern businesses continue to expand in size and complexity, more and more paperwork will lead to a moderate expansion in the employment of secretaries and stenographers. The increasing use of dictating, duplicating, and other office machines will undoubtedly continue, but technological changes of this kind are not expected to greatly effect the growth of employment in these occupations.

Openings for stenographers and secretaries may total more than 200,000 annually. Many thousands of workers will be hired to fill new jobs, but an even greater number will be needed to replace stenographers and secretaries who retire or stop working for other reasons. Turnover among stenographic workers is high because many young women work only a few years and then leave to care for their families. Some openings will also occur as stenographers and secretaries leave their jobs to enter other types of employment.

**Earnings and Working Conditions**

In 1965-66, the average weekly salary of persons employed in secretarial and stenographic positions in metropolitan areas was as follows:

	<i>Men</i>	<i>Women</i>
General stenographers . . . . .	\$107.50	\$83.50
Senior and technical stenographers . . . . .	114.50	96.50

The salaries paid to individuals included in the survey varied considerably, partly because of differences in the location and industry where they were employed, but also because of

differences in experience. For example, about one-half of all women employed as general stenographers earned between \$72 and \$94 a week.

The earnings of reporting stenographers are generally considerably higher than those of stenographic workers in business offices. According to the limited information available, some reporting stenographers earned between \$95 and \$100 a week in 1965, but many others earned more than \$150 or \$200 a week. A few earned even more.

The entrance salary for stenographers in the Federal Government in early 1967 was between \$75 and \$92 a week, depending on experience and education. In the Federal Civil Service, shorthand reporters (other than court reporters) capable of reporting a minimum of 160 words per minute start at about \$113 a week and may advance to \$193 a week. (See introductory section of this chapter for more information on Working Conditions.)

### Where To Go for More Information

Additional information on careers in secretarial work may be obtained from:

United Business Schools Association,  
1101 17th St. NW., Washington,  
D.C. 20036.

Information regarding shorthand reporting may be obtained from:

National Shorthand Reporters Association, 25 West Main St., Madison, Wis. 53703.

See introductory section of this chapter for additional sources of information.

### TYPISTS

(D.O.T. 203.138 through .588; 208.588; and 209.388 through .588)

#### Nature of Work

Typists operate the one machine found in practically every business

office—the typewriter. Their main job assignment is to produce typed copies of printed and handwritten materials; in this respect, their work differs from that of many other office employees, who also do some typing but whose principal job assignment is altogether different.

Practically all typewriters, including the electric machines being used in an increasing number of offices, have the same type keyboard and are operated in much the same way. Some typing jobs are considerably more difficult than others, however. Beginners, sometimes called *junior typists*, often address envelopes, type headings on form letters, copy directly from handwritten or typed drafts, and do other routine work. Experienced, or *senior typists*, generally perform work requiring a particularly high degree of accuracy or independent judgment; they may work from rough drafts which are difficult to read and which contain technical material, or they may plan and type complicated statistical tables, combine and rearrange materials from several different sources, or prepare master copies of material to be reproduced by photographic processes. A few specially trained typists operate teletypewriters, proportional spacing typewriters, and other special kinds of machines.

Many typists, because they use special equipment or have jobs involving special duties, also have special job titles. Thousands who combine typing with filing, sorting mail, answering the phone, and other general office work are called *clerk typists* (D.O.T. 209.588). Other, much smaller, groups of typists include *transcribing machine operators* (D.O.T. 208.588), who type letters and other documents as they listen to dictation recorded on tape or on sound-producing records; *data typists* (D.O.T. 213.588) and *tape perforator operators* (D.O.T. 203.588), who use specially equipped electric typewriters to transfer coded instructions to magnetic or paper tapes for use in electronic computers. Still other typists with special duties and job titles

include *policy writers* (D.O.T. 203.-588) in insurance companies, *waybill clerks* (D.O.T. 209.588) in railroad offices, and *mortgage clerks* (D.O.T. 203.588) in banks.

### Where Employed

About 700,000 workers were employed as typists in 1967; 95 percent were women. In addition, hundreds of thousands of workers in other kinds of clerical occupations also use typing skills in connection with their main job assignments.

Typists are employed in private and public enterprises of practically every kind—particularly in manufacturing firms, banks and insurance companies, and national, State, and local government agencies. More than two-thirds of all typists worked in such establishments in 1966.

### Training, Other Qualifications, and Advancement

Most applicants for typing positions are required by employers to meet certain standards of typing speed and accuracy. Usually, employers have applicants take tests which show how rapidly and accurately they are able to type. For most positions, typists must generally be able to type at least 40 or 50 words a minute. Typists should also have a good understanding of spelling, vocabulary, punctuation, and grammar.

Practically all prospective typists obtain the training needed by attending day or evening classes in public and private schools. High school graduates are generally preferred by employers. High school business training, including training in the operation of some of the simpler office machines, such as transcribing, copying, and adding machines, may be helpful to the applicant. Also the Federal Government sponsors training programs for unemployed and

underemployed workers for entry positions as typists under provisions of the Manpower Development and Training Act.

Important aptitudes and personality traits for this occupation include finger dexterity, accuracy, neatness, and ability to concentrate in the midst of distractions. A friendly manner and an attractive personality are great assets. Transcribing machine operators should have good hearing.

Promotion for a typist may be from a junior to a senior typing position, or to other clerical work involving greater responsibility and higher pay. Typists who complete training in shorthand may advance to stenographic or secretarial work.

### Employment Outlook

Employment opportunities for typists are expected to be very good during the rest of the 1960's and through the 1970's. More than 50,000 openings yearly are expected through the 1970's. Although a moderate increase in employment is anticipated, most openings will be for workers to replace typists who retire or stop working for other reasons. Turnover in this field is high because many young women work for only a few years and then leave to care for their families.

As modern businesses continue to expand in size and complexity, greater numbers of typists will be needed. However, duplicating machines and other mechanical equipment will probably be used frequently for routine typing and other clerical work done in offices, thereby limiting somewhat the demand for junior typists. The greatest demand is likely to be for typists who are able to do the relatively difficult work in senior typing jobs and for typists who can also do other kinds of office work.

### Earnings and Working Conditions

In 1965-66, the average weekly salary of people employed as typists,



Some typists use special typewriters.

in metropolitan areas surveyed by the BLS were as follows:

	<i>Men</i>	<i>Women</i>
General typists-----	\$87.00	\$70.50
Senior typists-----	102.50	84.50

The salaries paid to individuals included in the survey varied considerably, partly because of differences in the location and the industry where they were employed, but also because of differences in experience. For example, about one-half of those women employed as general typists earned between \$61.50 and \$78.50.

In the Federal Government, entrance salaries were \$69 and \$82 a week for typists depending on their education and experience.

Working conditions for typists are usually similar to those of other office workers in the firms where they are employed. (See introductory section of this chapter for information on Working Conditions and on Where To Go for More Information.)

### RECEPTIONISTS

(D.O.T. 237.368)

#### Nature of Work

Almost all very large offices and institutions—and many small ones as well—employ receptionists to receive and give information to the customers and other people who call. It is the receptionist's job to find out the nature of each caller's business, and then to direct him to those in the office who may be able to help him.

Receptionists who work for large establishments usually refer each caller to the appropriate company employee or official, or else contact his office by telephone and arrange an appointment. Other receptionists, because of the nature of the business or institution where they work, may have somewhat different duties. In a



employed as receptionists work principally in medical service and hospital jobs, in manufacturing, and in banking and credit agencies.

### Training, Other Qualifications, and Advancement

When hiring receptionists, employers seldom specify any formal educational requirements beyond a high school diploma. Nevertheless, about 1 receptionist in 5 has some college training. Business courses, including typewriting, elementary bookkeeping, and business practice, are assets for a beginner. The ability to operate an office telephone switchboard may also be desirable, although this skill is often acquired through on-the-job training. (See statement on Telephone Operators.)

Because the receptionist's job is to act as her employer's public representative, personal characteristics such as a pleasant manner and an even disposition are very important. An attractive personal appearance, pleasant speaking voice, good judgment, punctuality, and ability to communicate information accurately are also necessary qualities. In order to perform her job effectively, the receptionist should acquire a thorough understanding of how her employer's business is organized.

The receptionist's job generally offers limited opportunities for promotion and advancement. However, work as a receptionist, plus business training, may lead to a better paying position as a secretary or an administrative assistant.

### Employment Outlook

The number of receptionists is expected to increase very rapidly during the rest of the 1960's and through the 1970's. More than 25,000 workers will probably be needed annually because of employment growth and the need to replace receptionists who retire or stop working for other reasons. Many other openings will arise

hospital clinic, for example, the receptionist may direct each patient to the proper waiting room; in a beauty shop, she may arrange an appointment and accompany the customer to the operator's booth; and in a large defense plant, it may be part of the receptionist's job to provide the caller with an identity card and see that an escort is available to accompany him to the office of the official with whom he has business. In connection with duties such as these, many receptionists also keep records of the name of each caller and the nature of his business, the time of his call, and the person to whom he was referred.

Most receptionists, particularly in a small office, have some time when they are not occupied with callers, and they may handle other office tasks. Many receive and route telephone inquiries to the proper company officials. Typing, sorting and opening mail, filing, keeping books

or petty cash accounts, or operating an office telephone switchboard may be among their additional responsibilities.

### Where Employed

It is estimated that about 225,000 receptionists were working in the United States in early 1967. About 1 out of every 4 was a part-time worker who spent fewer than 35 hours a week on the job. More than 95 percent were women.

Although jobs for receptionists exist in practically all kinds of establishments, about half of the people in this occupation are employed in the offices of physicians, attorneys, and other professional people. Many others are employed by hospitals and educational institutions and still others by banks, insurance companies, real estate offices, manufacturing concerns, and beauty shops. The relatively small number of men who are

as receptionists transfer to other types of employment. However, young applicants will probably meet a good deal of competition, because many older and more experienced workers also seek employment in this type of work. A few opportunities will continue to be available for men.

The chief factor affecting employment growth in this occupation is the expected general business expansion associated with population growth and continued economic prosperity. Increasingly, both large and small business firms are realizing the importance of the receptionist in promoting good public relations. The receptionist's work is of a person-to-person nature, thus, it is likely to be little affected by office automation.

### Earnings and Working Conditions

According to a Bureau of Labor Statistics survey, switchboard-operator-receptionists earned an average of about \$80 a week in 1965-66; a few earned less than \$50 a week, others earned \$100 or more, a week.

In the Federal Government, workers employed as information receptionists started at about \$75 a week (\$3,925 a year) in early 1967. For experienced workers, starting salaries were higher—about \$82 or \$92 a week (\$4,269 or \$4,776 a year), depending on the nature of their previous experience.

Limited information available from a private survey indicates that many receptionists are paid salaries comparable to those of keypunch operators and typists. (See statements in this chapter for salary information on workers in these occupations.)

Particularly in large business offices, receptionists usually work in well-furnished front offices, free from noise and overcrowding. In hospitals, beauty shops, and some other types of businesses, scheduled hours may include some weekend and evening work. (See introductory section to this chapter for additional information on Working Conditions and for

Where To Go for More Information.)

## BOOKKEEPING WORKERS

(D.O.T. 210.368 through .588; 215.388 and .488; 216.388; and 219.388 and .488)

### Nature of Work

Every business concern must have systematic and up-to-date records of its financial affairs. Maintaining these records is the job of bookkeeping workers who record day-to-day business transactions in journals and ledgers and on other accounting forms. At regular intervals they also prepare summary statements showing, for example, the amount of money taken in and paid out by the firm, and from whom it came and to whom it went.

In many small establishments, one *general bookkeeper* (D.O.T. 210.-388) does all of the analysis, recording, and other work necessary to keep a complete set of books. Although employees in positions of this kind may use simple office equipment such as adding machines, they do most of their work by hand. Often they also file, answer the telephone, prepare and mail out customers' bills, and perform other general office work.

Large business organizations usually have bookkeeping departments

where many employees work under the direction of a head bookkeeper. In most departments of this kind, the *bookkeepers* (D.O.T. 210.388), *bookkeeping and accounting clerks* (D.O.T. 219.488), and *bookkeeping machine operators* (D.O.T. 215.388) each handle one or a few of the many kinds of work involved in keeping a complete set of books. Some of these workers may post items in accounts payable or receivable ledgers, and others may take trial balances, prepare summary reports, or do other bookkeeping work. Accounting clerks do much of their work by hand, but occasionally use adding machines. Bookkeeping machine operators use office machines which have keyboards similar to those on calculating machines.

### Where Employed

More than 1.2 million workers were employed in bookkeeping jobs in early 1967. Five out of six were women. The great majority of bookkeeping workers either do general bookkeeping or are accounting clerks; some operate bookkeeping machines. Large numbers of bookkeeping workers are employed in retail stores, banks, insurance companies, and manufacturing firms of almost every kind.

### Training, Other Qualifications, and Advancement

In selecting workers for bookkeeping jobs, most employers prefer high school graduates who have taken business arithmetic and bookkeeping. Some prefer applicants who have completed a post-high school business training program or junior college. Training which includes typewriting and the use of office machines is often very helpful, since many bookkeeping workers perform a variety of office duties. An increasing number of large companies offer some on-the-job training for newly hired accounting clerks and machine operators. In



Bookkeeping clerk checks invoices.

some localities, companies cooperate in work-study programs operated by high schools and business schools; students enrolled in these programs gain practical experience in part-time jobs that may be helpful in obtaining full-time employment after graduation.

Beginning bookkeeping workers, who usually start out recording routine transactions by machine or by hand, may advance to more varied assignments involving greater responsibility—for example, preparing summary reports or operating complex equipment such as the bookkeeping machines used in some banks. Some accounting clerks and bookkeeping machine operators may be promoted to supervisory bookkeeping positions. Bookkeepers who complete the college training necessary may advance to a position as an accountant.

(The occupation of Accountant is discussed elsewhere in the *Handbook*.)

General bookkeeping and accounting clerks should have above-average aptitude for working with numbers and the ability to concentrate on details. Bookkeeping machine operators need finger dexterity and good eye-and-hand coordination.

### Employment Outlook

The number of bookkeeping workers is expected to increase moderately during the rest of the 1960's and through the 1970's. The number of openings to be filled is expected to exceed 75,000 each year as new jobs are created and replacements are needed for employees who retire or stop working for other reasons. Additional thousands of workers will be needed annually to replace bookkeeping workers who transfer to other types of employment.

Employment in this field is expected to rise mainly as a result of the long-term growth of business and recordkeeping needs resulting from population expansion and economic prosperity. The increasing use of elec-

tronic data processing equipment and other mechanized bookkeeping machines, however is expected to limit somewhat the growth of employment requirements for bookkeeping workers. Many types of machines such as posting machines, punchcard machines, and electronic computers can process accounting and bookkeeping data more accurately, rapidly, and economically than can be done by hand. Nevertheless, the need for bookkeeping workers will probably outpace the laborsaving impact of office machines over the next 10 to 15 years.

#### Accounting clerks:

	Average weekly earnings, 1965-66	
	Women	Men
Class A.....	\$100.50	\$120.00
Class B.....	79.00	97.00
Bookkeeping machine operators:		
Class A.....	91.50	101.00
Class B.....	74.50	82.50

Working conditions for bookkeeping workers are usually similar to those of other office workers in the same firms. (See introductory section to this chapter for more information on Earnings and Working Conditions and on Where To Go for More Information.)

### CASHIERS

(D.O.T. 211.138, .368, .468, and .488 and 299.468)

#### Nature of Work

Practically all cashiers have one thing in common in their jobs—they receive the payments made by customers for goods and services. Apart from this, their duties may vary considerably, according to where they work. Job titles also differ. In a theater, for example, the cashier may be called *box office cashier* or *ticket seller*; in a supermarket, *checkout clerk* or *grocery checker*; in an electric light and power company, *teller* or *bill clerk*; and in a cafeteria, *cashier-checker*. Very large business firms with several cashiers sometimes use other special job titles such as

### Earnings and Working Conditions

A Bureau of Labor Statistics survey, covering office workers in 221 metropolitan areas throughout the country, provides information about the average salaries of some bookkeeping workers in 1965-66. This survey shows that average weekly earnings were considerably higher for "Class A" accounting clerks and bookkeeping machine operators (experienced employees who worked on relatively difficult assignments) than for "Class B" employees (who performed more routine work) as shown below:

	Average weekly earnings, 1965-66	
	Women	Men
Class A.....	\$100.50	\$120.00
Class B.....	79.00	97.00
Bookkeeping machine operators:		
Class A.....	91.50	101.00
Class B.....	74.50	82.50

*disbursement clerk, cash accounting clerk, or credit cashier.* (The occupation of bank cashier, which is altogether different from other kinds of cashier jobs, is discussed elsewhere in the *Handbook*.)

Regardless of job title or employer, most cashiers accept money paid by customers and clients, make change when necessary, and often give some kind of receipt for the payment. Records of the amount of money involved in each transaction are kept so that cash accounts can be balanced at the end of the day. Many cashiers also prepare cash and checks for deposit at the bank. Some, in addition to receiving and recording cash paid to their employers, are authorized to pay out cash or write company checks to cover such expenses as the purchase of supplies and equipment; they may also prepare pay envelopes or paychecks, make out sales tax reports, and do related work.

Cashiers—particularly those employed in very large establishments—often use machines which enable them to do their work more quickly and efficiently. Probably the best known of these machines is the cash register which, as the cashier rings up each sale, prints a record of the amount

on a paper tape and releases a money drawer. On some registers, cashiers list and total individual items purchased by each customer and record other details relating to the transaction. Other machines, somewhat like accounting machines, are used by cashiers in hotels and hospitals to record the charges for telephone, medical, and other services which are incurred and to prepare the itemized bills which cashiers present to guests or patients as they check out. Cashiers may also use adding machines, change-dispensing machines, and other special equipment.

Many cashiers have certain additional duties peculiar to the nature of their employers' businesses. In a theater, for example, the cashier may operate a ticket-dispensing machine and answer telephone inquiries. A restaurant cashier may handle reservations for meals and special parties, type menus, or be responsible for a sales counter stocked with candy, cigarettes and cigars, chewing gum, and other items. In supermarkets and other self-service stores, cashiers often wrap or bag each customer's purchases and, during slack periods, restock shelves, mark prices on articles, and perform other work. In a hotel or motel the cashier's special duties usually include recording charges for telephone, valet, and other services used by each guest, and notifying the room clerk when guests check out.

### Where Employed

Cashiers work for business firms of all types and sizes. More than half are employed in grocery, drug, and other retail stores; large numbers are also employed in restaurants, in theaters, and in hotels and motels. Most of these establishments and the other kinds of businesses where cashiers work—wholesale houses, and telephone companies, to name a few—are located in cities and in the shopping centers of heavily populated suburban areas, but some are also to be found in many small towns.



In early 1967, more than 700,000 cashiers were employed in the United States. About 1 out of 3 was a part-time worker who spent fewer than 35 hours a week on the job, and about 4 out of 5 were women. More than half of all women cashiers work in food stores, restaurants, and department and general merchandise stores. The largest single group of men cashiers work in food stores such as supermarkets.

### Training, Other Qualifications, and Advancement

Employers hiring beginners to fill jobs as cashiers prefer people who have completed high school. Courses in business arithmetic, bookkeeping,

typing, and other business subjects are considered good preparation. In some large cities, business organizations and schools offer brief courses through which students learn to operate the cash register and perform other duties of a cashier. Cashier training may also be offered as part of public school distributive education programs which include courses in retail selling or food service work.

For some kinds of cashier jobs, employers want persons with special skills or business experience—cashiers who know how to type, for example, or who have had selling experience. Sometimes cashier jobs are filled by promoting clerk-typists in offices, bag boys in supermarkets, and other qualified people already employed by the firm.

Beginners are usually trained in their duties by their employers. In most cases, this training is given informally as the new cashier works on the job under the close supervision of an experienced employee; sometimes trainees undergo a brief period of classroom instruction, particularly in large firms. Some firms provide training for all newly hired cashiers, regardless of previous experience.

To perform their duties rapidly and efficiently, cashiers should have an aptitude for working with figures, finger dexterity, and a high degree of eye-hand coordination. Accuracy is particularly important. Since cashiers deal with the public, they should also be tactful, neat in appearance, and able to deal with their customers in a pleasant and courteous manner.

Promotional opportunities for cashiers are likely to be limited, particularly in small firms. The cashier's job, nevertheless, affords a young person a good opportunity to learn how his employer's business affairs are conducted and so may serve as a steppingstone to a more responsible clerical job or to some types of managerial positions. In large hotels, for example, men who have worked as cashiers may advance to jobs as room clerks. In chainstores and other large retailing enterprises, some cashiers may eventually be advanced to positions as department or store managers, particularly if they supplement their experience with postsecondary work in retail store management.

### Employment Outlook

Employment in this large occupation is expected to increase very rapidly during the rest of the 1960's and through the 1970's. It is estimated that roughly 60,000 workers will be needed each year to fill new positions and to replace cashiers who retire or stop working for other reasons. Still other workers will be needed to replace cashiers who transfer to other types of employment.

Employment is expected to increase rapidly because of the anticipated ex-

pansion in business activities. In addition, more retail stores will undoubtedly adopt self-service and other merchandising techniques which create jobs for cashiers. The increase in employment due to changes of this kind, however, will probably be somewhat less marked than during the 1950's when conversion to self-service on the part of some kinds of retailers was widespread. The continued use of vending machines, changemaking machines, and other mechanical equipment which replaces cashiers or speeds up their work will also tend to limit the expansion in employment during the coming decade.

Competition among applicants for cashier jobs is likely to be keen, since many openings can be filled by persons who have little specialized training. Opportunities will probably continue to be best for cashiers with typing, bookkeeping, or other special skills. There should be many opportunities, also, for cashiers who wish to work part time.

### Earnings and Working Conditions

The salaries paid beginning cashiers in routine jobs are often at or near the minimum wage required by State and Federal laws. In several States and in establishments covered by the Federal law, the minimum was \$1.40 an hour in 1967; elsewhere, starting salaries were somewhat lower. Unionized cashiers as well as some others in jobs which involve a considerable degree of responsibility or require specialized training may earn considerably more than the legal minimum; often more than \$2 an hour. Grocery checkers employed by supermarkets may earn more than \$3 an hour.

Cashiers' hours may differ from those of many other clerical workers because they often work during rush periods which are outside regular office hours—at mealtimes in restaurants and during evenings and weekends in stores and theaters, for example. Cashiers employed full time in

supermarkets and other large retail establishments usually work a 5-day, 40-hour week but, since Saturday is a busy day in retailing, most cashiers usually work on that day and have another day off during the week. Holiday, weekend, and late afternoon work may be required, especially in theaters, restaurants, and food stores. Many cashiers in such establishments work part time or on split shifts.

Most cashiers work indoors, often in small booths or cages or behind counters near the entrances of stores, theaters, and other establishments. In some cases, their quarters may be uncomfortable because they are exposed to cold drafts in the winter and considerable heat during the summer.

(See introductory section of this chapter for Where To Go for More Information.)

### OFFICE MACHINE OPERATORS

(D.O.T. 207.782, .884 and .885; 208.782; 213.582, .782 and .885; 214.488; 316.-488; 234.582 and .885)

#### Nature of Work

The types of machines used to speed the paperwork in modern business offices are so varied that it would be almost impossible to list them all. They range from simple mechanical devices that open letters to electronic equipment capable of performing highly involved computations. This statement is concerned with the work done by people whose main job is to operate some of the more common types of office machines. Many of these workers, such as the keypunch operator and billing machine operator, have job titles taken from the kinds of equipment they use. (Typists, operators of transcribing and bookkeeping machines and operators of electronic computer systems are not included in this statement, but are discussed in other sections of this chapter. Others not included are clerical workers who occasionally use equipment such as copying machines, adding machines, and other mechan-



ical devices; and statistical clerks who use calculating machines extensively in connection with their regular duties.)

*Billing machine operators* (D.O.T. 214.488) use machines that both type and add while preparing statements relating to customers' purchases. By striking lettered and numbered keys on the machine, the operator enters on each bill information such as the customer's name and address, the items bought, and the amounts of money involved in each transaction. Then, when other keys are pressed, the machine calculates and prints totals, discounts, and other items.

*Adding and calculating machine operators* (D.O.T. 216.488) use electrically and manually operated machines to make the computations needed in preparing payrolls and invoices, and in doing other statistical work. By striking numbered keys, operators "put into" these machines the numbers involved in each calculation and then, when other keys are pressed, the machines make the desired calculations and record the results automatically. *Adding machine operators* use their machines to add and subtract numbers, and sometimes to multiply. The calculator is more complex than the adding machine and has a much larger keyboard. *Calculating machine operators* use the calculator, not only to add, subtract, multiply, and divide, but to get square roots, figure percentage distributions, and do other computations. Many office workers who operate adding machines and calculators a part of the time also perform other office duties. However, operators of the most complex calculating machines—that is, key-driven calculators which require considerable skill and knowledge—usually spend full time in this work.

*Mail preparing and mail handling machine operators* (D.O.T. 234.582 and .885) run automatic equipment which handles incoming and outgoing mail. Only in offices which handle a very large volume of mail does this work require a full time operator. Some operators feed incoming mail



Supervisor explains machine operation to new employee.

into machines which open the envelopes. Other operators place outgoing mail on the loading racks of machines which fold enclosures and/or insert them in envelopes or address, seal, or stamp envelopes. Operators of addressing machines, who work mainly in offices where circulars, magazines, and other materials are regularly sent to people on mailing lists, run machines which print addresses and related information either from stencils which have been cut by typists or else from plates prepared by *embossing machine operators* (D.O.T. 208.782) on a special kind of typing machine.

Operators of duplicating and copying machines run equipment which produces copies of typewritten, printed, and handwritten documents more quickly and/or inexpensively than is possible by typing. Some equipment of this kind—particularly

copying machines which use photographic and other chemical processes—is used chiefly to make only a limited number of copies of a document and can be operated by almost any office employee who has taken a few minutes to learn how. Full-time machine operators are seldom used for this work. Other, more complicated duplicating machines, which are capable of producing thousands of copies of typewritten and handwritten documents in a single "run," are usually operated by trained *duplicating machine operators* (D.O.T. 207.782, .884 and .885) who spend most of their time doing this work. The operators who run these machines insert in the machine a "master" copy of the document to be reproduced (a stencil or reproduction mat on some machines, and on others raised type) and then adjust the mechanism and start the machine.

Each operator must see that the machine is kept properly adjusted so that it produces legible copies. On some machines, the operator also feeds in the paper used for making copies and removes finished batches of work manually; on other machines, feeding and offbearing are done automatically.

*Operators of tabulating machines and related equipment* (D.O.T. 213-782) run machines designed to sort and count large quantities of accounting and statistical information. Information to be processed in a tabulating machine is first transferred to cards by *keypunch operators* (D.O.T. 213.582). Using machines similar in action to typewriters, these workers punch holes in the cards in such a position that each hole can be identified as representing a specific item of information. These punched cards may be used with electronic computers as well as tabulating machines. (See statement on Electronic Computer Operating Personnel elsewhere in this chapter.) *Sorting machine operators* (D.O.T. 213.885) then run the punched cards through sorting machines which automatically separate the cards according to the location of the holes and arrange them in any desired order. Next, *tabulating machine operators* (D.O.T. 213.782) insert the batches of punched cards into machines which count the various items punched on each card, multiply and make other calculations, and print the results on accounting records and other business forms.

### Where Employed

About 335,000 people were employed as office machine operators in early 1967. (This total does not include more than 150,000 operators who run bookkeeping machines and electronic computer systems. These occupations are discussed elsewhere in this chapter.) About three-fourths of all office machine operators are women. Women outnumber men in practically all types of jobs except

those which involve operating tabulating machines.

Office machine operators are employed mainly in firms handling a large volume of recordkeeping and other paperwork. Consequently, a great many operators work in large cities where such firms are usually located. Approximately one-third of all office machine operators work for manufacturing companies. Others work for banks and insurance companies, government agencies, and wholesale and retail firms. Some office machine operators are employed in "service centers"—agencies which are equipped with various kinds of office machines and contract to handle, for other firms without this equipment, such tasks as preparing monthly bills and mailing circulars to lists of prospective customers.

### Training, Other Qualifications, and Advancement

Graduation from high school or business school is the minimum educational requirement for all but the most routine office machine operator jobs. For work such as operating key driven calculators and some kinds of tabulating and duplicating equipment, specialized training is usually necessary. For many beginning positions, however, a general knowledge of the equipment used is usually regarded as sufficient. Public and private school courses in the operation of office machines are helpful, and business arithmetic is valuable for the many jobs involving work with figures. It is helpful also for office machine operators to have some knowledge of typing, or to be able to operate more than one type of office equipment, since many office positions entail varied assignments.

Employers usually give newly hired office machine operators some on-the-job training. Even employees who have some earlier training or experience in office machine operation need to become familiar with the particular equipment they will be using on the job; differences exist be-

tween the calculating machines produced by one manufacturer and by another, for example, and new models sometimes differ considerably from older models.

The amount of instruction and on-the-job experience needed by a beginner varies, depending chiefly on the type of machine. A few days only may be required to train operators of some duplicating machines, for example; a few weeks may be needed for the training of keypunch and calculating machine operators. Generally, several weeks are required for operators of tabulating machines to learn how to set and adjust their equipment and do simple wiring of plugboards. Operators of tabulating equipment are often trained at company expense in special schools established by equipment manufacturers.

Finger dexterity, coordination of eye and hand movements, and good vision are important for most office machine operator jobs. It is helpful for billing and calculating machine operators to have a sufficient sense of mathematical relationships to enable them to detect quickly obvious errors in computations. Some mechanical ability is advantageous, especially for duplicating and tabulating machine operators.

Most employers follow a promotion-from-within policy, taking into consideration seniority and on-the-job performance as shown by supervisors' ratings and recommendations. Promotion may be from a beginning, routine machine job to a more complex one—for example, from keypunch operator to tabulating machine operator—or the promotion may be to a related clerical job, as in the case of a billing machine operator who is promoted to a position as accounting clerk; often, employers provide the additional training required in such cases. Advancement for office machine operators employed in firms which have large clerical staffs may be to positions in which they are responsible for training beginners and for the accuracy of their work, or else to supervisory positions as section or department heads.

## Employment Outlook

More than 40,000 job openings for office machine operators are expected to occur each year during the late 1960's and through the remainder of the 1970's. Most of these openings will arise as business organizations continue to grow in size and number, and the volume of billing, computing, duplicating, and other work continues to mount. Other openings for office machine operators probably will be created by the introduction of new types of mechanical office equipment which speed recording, copying, and other office work. Still other openings will occur because of the need to replace workers who retire or stop working for other reasons. Many machine operators are young women who stop working after a few years of employment in order to stay at home and care for their families.

The number of office machine operators is expected to increase very rapidly during the remainder of the 1960's and through the 1970's. In some offices, however, the number of workers needed to operate tabulating, billing, and other types of machines may be reduced due to the spread of automated recordkeeping systems and further advances in office automation. Also, advances in interoffice communications devices for transmitting data and electronic computer technology should enable many large firms and government agencies to centralize recordkeeping functions, thus reducing the requirements for office machine operators in small branch offices. Nevertheless, any reduction in employment is expected to be limited to a relatively small number of offices and will be more than offset by the new jobs created as the volume of paperwork continues to increase in business establishments of all kinds.

## Earnings and Working Conditions

A 1965-66 Bureau of Labor Statistics survey, covering firms in metropolitan areas, provides information

about salaries in several office machine operator occupations. For keypunch and tabulating machine operators, the averages are given separately for different skill groups; operators in Class A were generally experienced employees who did com-

paratively difficult work, whereas Class B and Class C operators worked on more routine assignments and used simpler types of equipment. The average weekly salaries reported by this survey are shown in the accompanying tabulation.

	Average weekly salaries, 1965-66	
	Women	Men
Billing machine operators.....	\$78. 50	\$104. 50
Comptometer operators.....	84. 00	.....
Duplicating machine operators.....	76. 00	80. 50
Keypunch operators:		
Class A.....	90. 50	102. 00
Class B.....	77. 50	89. 50
Tabulating machine operators:		
Class A.....	112. 50	121. 50
Class B.....	93. 50	103. 00
Class C.....	78. 00	83. 00

—Because of the noise created by their machines, operators often work in groups in areas which are apart from other company offices. In other respects, working conditions for office machine operators usually are similar to those of other office workers in the same firms. (See introductory section to this chapter for additional information on Working Conditions and for Where To Go for More Information.)

## ELECTRONIC COMPUTER OPERATING PERSONNEL

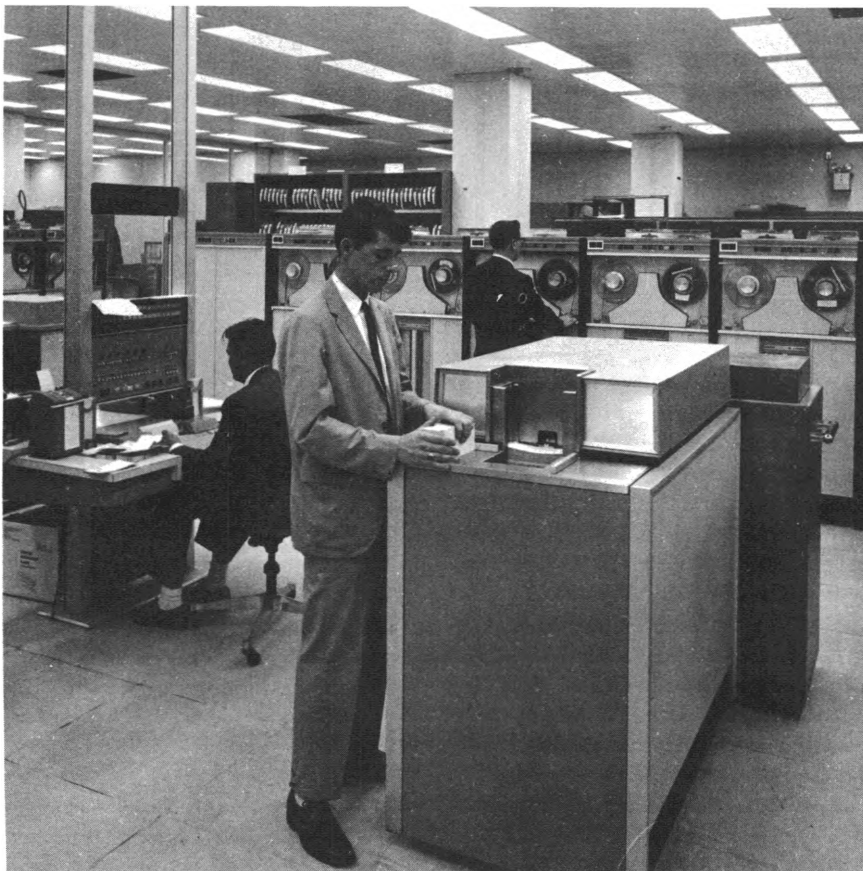
(D.O.T. 213.138, .382, .582, and .588 and 233.387)

### Nature of Work

Operators of several kinds of mechanical equipment may be required whenever an electronic computer is used to prepare a payroll or to "process" other data. First, the computer's "input" must be prepared in a special code—the "machine language" which will enable the computer to process the data—then, the computer console must be operated while the work is being done; and, finally, the computer's "output," must be translated back into words and numbers which can be read. The procedures employed in accomplishing this work

vary from one computer system to another; often they are more involved and more difficult to learn than the operation of the equipment itself. The number and kinds of employees needed also vary for different computer installations. A small system—and some computers are no bigger than an office desk—may be operated entirely by one or two employees. A large system, on the other hand, usually requires several workers, each of whom is assigned a specific task.

A computer's input consists of the data to be processed and the step-by-step instructions prepared by programmers which tell the machine how to do the work. (Information about the occupation of Programmer is given elsewhere in the *Handbook*.) In many computer systems, the input consists of punched cards prepared by *keypunch operators* (D.O.T. 213.582) or of paper tapes prepared by *data typists* (D.O.T. 213.588); less frequently, input may be prepared by operators of adding or bookkeeping machines with special attachments which perforate tapes. These machine operators do much the same work as those who use the same general type of equipment for other purposes. (For additional information on these occupations, see statements on Typists, Office Machine Operators, and Bookkeeping Workers in this chapter.)



Computer console and auxiliary equipment operators work in teams.

In some computer systems, punched cards or paper tapes can be used directly to feed information into the central computer. The fastest computer systems, however, get their input from magnetic tapes (narrow strips of plastic tape, on which data have been recorded in the form of magnetic spots or characters). Such computer systems include auxiliary equipment which transfers data from punched cards or paper tapes to magnetic tape. In some systems, this work is done on small computers. Other machines, used for the same purpose, are called converters and are run by *card-to-tape converter operators* (D.O.T. 213.382). Converter operators may be required to wire a fairly simple plugboard, and they must know how to interpret signals from a panel of lights on the machine. They also should have sufficient understanding of the whole computer sys-

tem to recognize any errors that may have occurred in preparing input or to identify other situations which could prevent the system from operating properly.

Once the facts and figures to be processed have been converted into the form used by the computer, the data are ready for the "run"—that is, for processing in the computer. Operating the computer is the responsibility of the *console operator* (D.O.T. 213.382), or computer operator, as he is sometimes called. The console operator first examines the programmer's instruction sheet for the run and ascertains the procedure to be followed. He then readies the equipment, makes sure the computer is loaded with the tape or cards needed, and starts the run. As he operates the console during the run, he may have dozens of switches to manipulate and lights to observe. If the

computer stops running, or its lights signal an error, he must try to locate the source of the trouble.

Before a computer's output can be read, it must be translated from machine language to words and numbers. In some systems, this is done by machines directly connected to the computer and run by the console operator or his assistant. In many large systems, however, this work is done on converters, highspeed printers, and other machines run by auxiliary equipment operators—*tape-to-card converter operators* (D.O.T. 213.382), *high speed printer operators* (D.O.T. 213.382), and others. Like operators of other kinds of auxiliary equipment, these operators may have to wire plugboards and watch for lights on their machines which signify errors. Some types of auxiliary equipment are relatively difficult to operate and, when computer systems include such equipment, operators sometimes specialize on one kind of machine. Many operators, however, run all kinds of auxiliary equipment used in a computer system.

The tape or cards used in processing data on a computer are stored after the run, and are often used again and again—as, for example, in making up a payroll at the end of every pay period. A *tape librarian* (D.O.T. 223.387), or a console operator or *auxiliary equipment operator*, may be responsible for storing tapes and making them available when they are again needed.

Many electronic computers are operated for as long as 16 to 24 hours a day. In such cases, they may be operated by two or three different shifts of workers. Usually all operators work under the general direction of a chief supervisor, and employees on each shift work under the direct supervision of the console operator on that shift.

### Where Employed

The number of console and auxiliary equipment operators employed in mid-1966 is estimated at roughly

100,000. Jobs for operating personnel are found chiefly in government agencies and in insurance companies, banks, wholesale and retail businesses, transportation and public utility companies, and manufacturing firms. Many operators are also employed in independent service organizations which process data for other firms on a fee basis.

### **Training, Other Qualifications, and Advancement**

When installing electronic computers, employers often fill as many of their new operator positions as possible by transferring employees from other types of jobs, frequently from jobs as operators of the tabulating and bookkeeping machines which may no longer be needed after the computer is installed. Many computer operators are also recruited from outside the firm.

In hiring outsiders, private employers usually require at least high school graduation. For positions as console operator, some college training may be preferred. In the Federal Government, applicants for auxiliary equipment operator jobs must be high school graduates, unless they have had specialized training or previous experience in some related work. Console operators employed by the Federal Government are generally required to have a college education or its equivalent in work experience; or they may be able to qualify for appointment on the basis of previous experience in computer work and general aptitude for it, as demonstrated by special tests. Many private employers also screen applicants for operating positions by giving them tests designed to measure their aptitude for the work, especially their ability to reason logically.

Beginners hired for work of this kind, or transferred to it from other positions in their firms, are seldom expected to have had specific training as operators. Most employers provide the necessary training after the work-

er is hired. The training of auxiliary equipment operators may require a few weeks, that of console operators somewhat longer. Console operators usually attend classes where they learn how to mount tapes and operate the console and become sufficiently familiar with the equipment they are using to be able to trace the reasons for mechanical failures. This training is supplemented by further instruction on the job.

As they gain experience, operating personnel may be assigned to operate more complex pieces of equipment. Eventually they may be promoted to supervisory positions or jobs which combine some supervisory duties with console operation. Console operators may acquire, through on-the-job experience, an understanding of programming which, with additional training, may enable them to qualify for work as programmers.

### **Employment Outlook**

A growing and increasingly complex economy is expected to cause the use of electronic data-processing equipment to continue to increase very rapidly throughout the late 1960's and the 1970's. Computers are being put to new uses almost daily, and, as the tasks they perform become even more varied, many more business firms will be utilizing them. Although the size of the staff required to operate a computer installation may be reduced somewhat as new types of equipment are developed, the total number of computer and auxiliary equipment operators is expected to increase very rapidly, nevertheless.

Thousands of operators will be needed to fill new jobs, both in firms with their own computer installations and in service centers which rent computer time to businessmen. Many operators will also be needed to replace operators of computer systems who transfer to other kinds of work or stop working. As in the past, employers will fill some positions by training people already in their em-

ploy, but many others will be filled by hiring outsiders.

The equipment changes which are expected in computers may also produce changes in job requirements for console and auxiliary equipment operators. Because of advances in technology, much of the equipment in use today is far less complex to operate than the first computers of the early 1950's; and future changes may bring further simplification. As a consequence, newcomers to this field may find it easier than have applicants in the past to qualify for the openings available, but competition for those jobs that become available is likely to become correspondingly greater.

### **Earnings and Working Conditions**

Information about the salaries of computer operating personnel in over 2,000 companies throughout the country is available from a private survey conducted in 1966. The average salary for beginning console operators was \$101 a week. Experienced console operators averaged up to \$180 a week. The salaries of auxiliary equipment operators working with high-speed printers average \$127 and tape librarians averaged \$118 a week. The difference between the salary of the lowest and highest paid employees in each of the job classifications surveyed was much greater than these figures suggest, however. For example, the highest salary reported for a skilled console operator was \$267 a week—about three times the lowest salary reported for a comparable job. Many differences of this kind were due to differences in salary levels in various parts of the country and in individual companies and industries; to some extent, they were also due to differences in the complexity of the work performed by operators with the same job titles.

Salaries of computer personnel in the Federal Government are roughly comparable with those in private industry. In early 1967, beginning console operators started at about \$103 a

week (\$5,331 a year) and auxiliary equipment operators at about \$82 a week (\$4,269 a year). The maximum salary paid to experienced console operators in the Federal Government was about \$193 a week (\$10,045 a year); a few in supervisory positions may earn up to about \$276 a week (\$14,338 a year), usually after several years of experience. Skilled auxiliary equipment operators earned up to about \$133 a week (\$6,915 a year) after several years of experience.

Operators of electronic computer systems generally work the same number of weekly hours and are allowed the same holidays, vacations, and other benefits as most office employees. Since many computers are operated on a two- or three-shift basis, scheduled hours for some console and auxiliary equipment operators in-

clude late evening or nightwork. Tape librarians usually work only when day shifts are on duty. (See introduction to this chapter for additional information on Working Conditions.)

### Where To Go for More Information

Information on careers in electronic data processing may be obtained from:

Data Processing Management Association, 524 Busse Highway, Park Ridge, Ill. 60068.

A bibliography which includes materials giving information about computer operating personnel may be obtained from:

Association for Computing Machinery, 211 East 43d St., New York, N.Y. 10017.

## TELEPHONE OPERATORS

(D.O.T. 235.862)

### Nature of Work

Although millions of telephone calls are dialed each day without the assistance of a telephone operator, practically every telephone user sometimes makes a call that cannot be completed without the operator's help. Often the call is a long distance one on which the operator is asked to reverse charges, locate a particular individual, or provide information about the cost of the call. Frequently, the caller needs help because he does not have the correct telephone number. Or, the operator's services may be needed to call the police in an emergency, assist a blind person who is unable to dial for himself, or arrange a conference telephone call which will enable business executives in several different locations to confer by telephone.

These and many other services are provided by two groups of telephone operators—those who work at the switchboards in central offices of telephone companies; and operators or attendants who work at private branch exchange (PBX) switchboards in other types of enterprises. Usually, workers in both groups operate their equipment by inserting and removing plugs attached to cords, by manipulating keys and dials, and by listening and speaking into their headsets. Some switchboards are of the keyboard type and are operated by pushbuttons and dials.

*Central office operators* are usually contacted only when callers need assistance. Because assistance is most frequently sought for long distance calls, most central office operators are *long distance operators*. They obtain from each caller the information needed to complete the call, make the necessary connections with the party being called, and record the details of each call for billing purposes. Many *information operators* (D.O.T. 235.-862) also work in telephone com-



Traffic operator handles long distance calls.

panies; they provide callers and long distance operators with telephone numbers by searching in telephone directories and other records for addresses, numbers of new subscribers, and other information. *Central office supervisors* are responsible for training newly hired operators; they also aid operators in completing especially difficult calls. In each central office, all operators work under the direction of a *chief operator*, who is responsible for the overall efficiency of the office.

*PBX operators* (D.O.T. 235.862) operate switchboards which serve groups of telephone users in business offices and other establishments, and which are connected with telephone company lines. In addition to making connections for interoffice or house calls, they answer and relay to the proper parties the calls from the outside, assist other company employees in making outgoing calls, supply information to callers, and record charges for the calls which go through their switchboards. Many operators work at large PBX boards which serve dial telephones; their duties are very much the same as those of central office operators. In many small establishments, however, PBX operators work at switchboards which serve only a limited number of telephones, and, when not busy at their switchboards, these operators do other office work such as typing, proofreading, or sorting mail. Many act as receptionists or information clerks. (The work of the receptionist is described elsewhere in this chapter.)

### Where Employed

Almost 400,000 people were employed as telephone operators in early 1967. Practically all were women.

Central office operators in telephone companies slightly outnumbered PBX operators in other types of establishments. Although PBX operators worked in establishments of all kinds, a particularly large number were employed in manufacturing plants, hospitals, schools, and department stores. Jobs for both central



Information operator finds number for caller.

office and PBX operators tend to be concentrated in heavily populated areas. Nearly one-fifth of the total operators were employed in the New York, Chicago, and Los Angeles metropolitan area, for example.

### Training, Other Qualifications, and Advancement

In hiring beginners, employers prefer young people who have at least a high school education. Courses in English and business arithmetic provide good preparation. Since many PBX operator positions combine switchboard duties with other office

work, courses in typing, and other commercial subjects may also be helpful.

Although brief courses in switchboard operation are available at a limited number of private and public schools, practically all newly hired operators receive some on-the-job training in order to familiarize themselves with the equipment they will use, the kinds of records to be kept, and any additional duties for which they will be responsible. In telephone company central offices, operators first learn the various procedures used in handling calls. They then put through practice calls. Following this period of instruction and practice—which us-

usually lasts from 1 to 3 weeks—they are assigned to the regular operating force in a central office where they receive further instruction in handling special types of calls not included in their initial training.

Many PBX operators handle comparatively routine calls and, therefore, their period of training may be somewhat shorter than that of central office operators. In a large business, training is often given by a training supervisor in the company's employ or by an instructor who works for the local telephone company. In a small establishment, another employee who is experienced in switchboard operation usually does the training. The telephone operator's job is becoming less repetitive, largely because of the increasing use of direct dialing; thus public contacts make up an increasing proportion of their work. Operators must be tactful and courteous; in providing the services requested by telephone users, they must often exercise initiative as well as patience and persistence. A pleasing telephone voice with no noticeable speech impediment is important. A high degree of eye-hand coordination and normal eyesight and hearing are also helpful. Most telephone companies and many large business firms require applicants to pass physical examinations and general intelligence tests. Ability to type and other clerical skills may be required for some PBX positions.

An experienced central office operator may be promoted to central office supervisor and, eventually, to chief operator. Promotion may also be to a clerical job or some other position within the telephone company at a higher salary. Similar opportunities exist for PBX operators in large firms; in many small businesses, however, opportunities for advancement are limited.

### Employment Outlook

Employment of telephone operators is expected to rise slowly during the remainder of the 1960's and

through the 1970's. In addition, many thousands of job openings will become available annually in this large occupation. Most openings—an estimated 25,000 each year—will be to replace central office and PBX operators who retire or stop working for other reasons. Turnover is high, particularly because most telephone operators are young women who work for only a few years and then leave to care for their families. Additional operators will also be needed to replace workers who transfer to other types of employment.

Direct dialing and other changes have been under way for some years in telephone company offices and have tended to restrict growth in central office operator employment. Technological change will probably continue. At the same time, however, further increases are anticipated in the volume of calls handled by telephone companies, consequently, little change in the employment of central office operators is expected through the 1970's.

The number of PBX operators, on the other hand, is expected to rise moderately over the remainder of the decade and throughout the 1970's. Employment in most PBX installations is expected to be relatively unaffected by further technological

change. Some large PBX installations may install modern laborsaving equipment, but its limiting effect on employment should be more than offset by the number of new jobs created as more businesses require PBX services.

### Earnings and Working Conditions

Central office operators in training averaged \$1.82 an hour in December 1965, according to a Bureau of Labor Statistics survey. For experienced telephone operators, the average was \$2.17 an hour, for service assistants (central office supervisors), \$2.66, and for chief operators, \$3.39. Salary levels varied in different sections of the country; they were highest in the Pacific States, where experienced operators averaged \$2.37 an hour. Pay scales established by contracts between unions and telephone companies generally provide for periodic salary increases to operators. Central office operators usually receive extra pay for work on evenings, Sundays, and Holidays.

The lowest and highest average weekly earnings of PBX operators in nonsupervisory positions, reported in a BLS survey of cities in four regions, were as follows:

*Average weekly earnings, 1965-66*

	High		Low	
	<i>Class A operator</i>	<i>Class B operator</i>	<i>Class A operator</i>	<i>Class B operator</i>
Northeast.....	\$101.50 (Paterson-Clifton-Passaic).	\$84.50 (New York)	\$77.00 (Providence-Pawtucket-Warwick).	\$57.50 (York).
South.....	\$101.50 (Fort Worth).	\$74.50 (Beaumont-Port Arthur-Orange).	\$77.00 (New Orleans)...	\$50.00 (Memphis).
North-central...	\$107.50 (Detroit)....	\$84.00 (Youngstown-Warren).	\$80.50 (Des Moines)....	\$58.00 (Omaha).
West.....	\$103.50 (Los Angeles-Long Beach).	\$85.50 (San Francisco-Oakland).	\$65.50 (Boise City)....	\$61.50 (Phoenix).

Earnings varied not only according to the section of the country, but according to the industry in which PBX operators were employed. For example, the average for class A PBX operators in Chicago in public utilities was \$104 a week and in manufacturing establishments, the weekly average was \$96.50.

The workweek for most central office and PBX operators averaged be-

tween 35 and 40 hours. Often, their scheduled hours are approximately the same as for other workers in the business community. In telephone companies, however, and in hotels, hospitals, and other establishments where telephone service is maintained on a 24-hour basis, operators usually work on shifts and on holidays and weekends. Some central office operators work split shifts—that is, they



are on duty during the peak calling periods which occur in the late morning and early evening, and have time off between these two periods.

Operators in most telephone companies and other large establishments usually work in well-lighted and pleasant surroundings. Attractive lounges are often provided for relaxation during "breaks" in their scheduled hours. Insurance and pension plans and practices relating to paid holidays and vacations are much the same as those for other types of clerical employees.

Many operators employed by telephone companies are members of the Communications Workers of America and the Alliance of Independent Telephone Unions.

See telephone industry chapter and introductory section of this chapter for Where To Go for More Information.

## SHIPPING AND RECEIVING CLERKS

(D.O.T. 222.138 through .687)

### Nature of Work

Shipping clerks and receiving clerks do the clerical work that is necessary to enable manufacturing companies, wholesalers, and other business firms to keep track of goods transferred from one place to another. The specific duties of shipping and receiving clerks depend on the size and type of establishment in which they work. In a great many companies, one clerk keeps records of all shipments sent out and received by his employer. In larger companies, however, shipping and receiving clerks may be employed in separate departments, working under the direction of supervisors who are often called head shipping clerks or head receiving clerks—or sometimes warehouse managers.

Before a shipment is sent out from a business establishment to a custom-

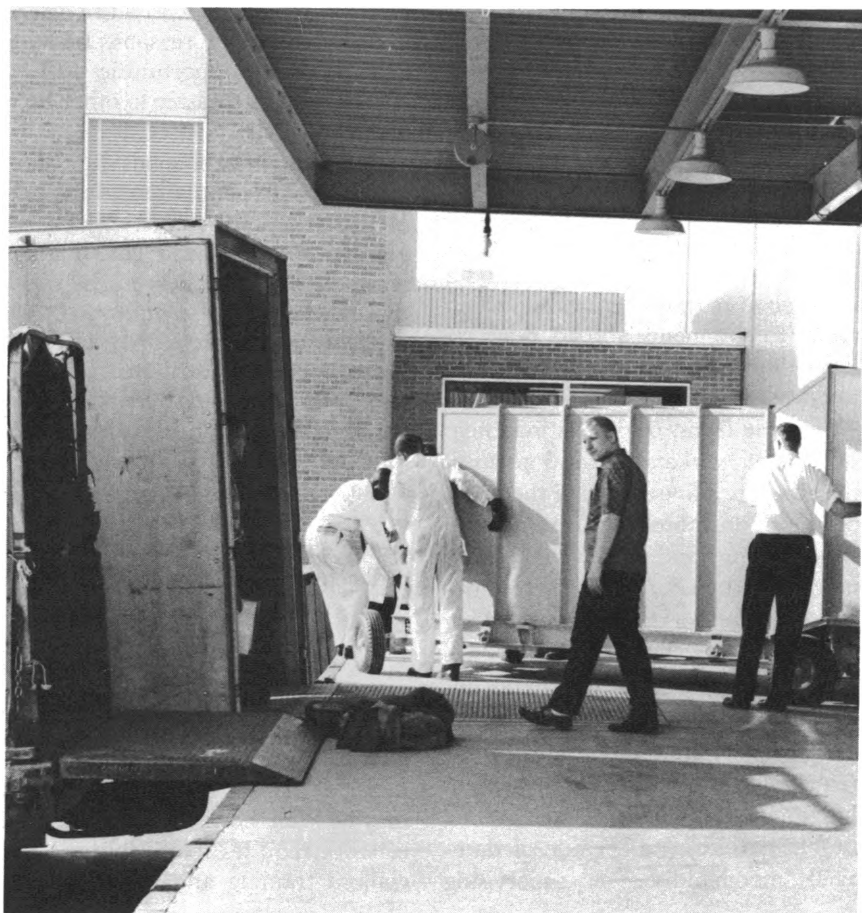
er, shipping clerks check to be sure the customer's order has been correctly filled. They type or prepare by hand the invoices and other shipping forms needed, look up freight and postal rates, record the weight and cost of each shipment, and check to see that the shipment is properly addressed. They also keep records of the date and other details associated with each shipment. Sometimes shipping clerks requisition from the firm's stockroom the merchandise which is needed to fill each order, wrap and pack the shipment, and direct its loading on company trucks, ensuring that the weight is evenly distributed and fragile items are safely placed.

Receiving clerks do similar work when shipments reach their destination. They find out whether their employer's orders have been correctly

filled by verifying incoming shipments against the original order and the accompanying bill of lading invoice, or other record; and they check to see whether the merchandise in each shipment has arrived in good condition. Receiving clerks maintain records of all incoming shipments and the condition in which they were received, and they do other clerical work related to damaged or lost shipments. Routing shipments to the proper department of the company or section of the warehouse or to the stockroom may also be part of their job.

### Where Employed

The number of shipping and receiving clerks employed in early 1967 is estimated at more than 325,000. Two out of every three worked in



manufacturing firms and another fairly large group worked for wholesale houses or retail stores. The remainder were employed by transportation and freight forwarding companies, and by many other kinds of business firms. About 90 percent of all shipping and receiving clerks are men.

Shipping and receiving clerks are employed in large factories, warehouses, and stores. The majority work in metropolitan areas, where such establishments tend to be concentrated.

### Training, Other Qualifications, and Advancement

High school graduates are preferred for beginning jobs in shipping and receiving departments. Business arithmetic, typing, and other high school business subjects are helpful in preparing for the work. The ability to write legibly is important. Dependability and an interest in learning about the firm's business activities are also qualities which employers seek.

New employees are usually given on-the-job training under the supervision of an experienced worker. Special care and skill is required, for example, when the shipments handled include such merchandise as garments or scientific instruments; and a knowledge of the regulations which apply to shipments abroad is necessary when merchandise is forwarded to other countries.

In some firms, beginners may help stockroom workers for a time until they acquire a knowledge of the firm's products and business transactions. In shipping and receiving rooms, newly hired clerks often start by doing routine work such as checking addresses, attaching labels to shipments and checking the items included, or filing. As clerks acquire experience, they may be assigned tasks requiring a good deal of independent judgment—for example, handling problems that arise because of damaged merchandise, or supervising

other shipping or receiving room workers.

Work as a shipping or receiving clerk provides an excellent opportunity for an ambitious young man to learn about his company's products and business connections. Some clerks, particularly those who acquire postsecondary training or take courses in transportation, may eventually advance to positions as warehouse managers, industrial traffic managers, or purchasing agents. (The work of industrial traffic managers and purchasing agents is discussed elsewhere in the *Handbook*.)

### Employment Outlook

During the rest of the 1960's and through the 1970's, approximately 7,000 job openings for shipping and receiving clerks are expected to arise annually as employment in this occupation rises and as replacements are needed for workers who retire or stop working for other reasons. In addition, other job opportunities will occur as workers transfer to other types of employment.

As the quantity of goods distributed increases with population growth, rising income levels, and business expansion, the number of shipping and receiving clerks is likely to rise slowly through the 1970's. Employment will probably rise more slowly than the volume of goods distributed. Shipping and receiving departments in firms handling large quantities of merchandise will undoubtedly be able to handle a greater volume of work with fewer clerks, as they continue to increase efficiency by streamlining recordkeeping and modernizing warehouses through installation of moving belts and other laborsaving equipment. Even so, there probably will be a gradual increase in the number of clerks whose main job assignment is in shipping or receiving work. Competition for the openings that arise may be keen, however, since this kind of work requires relatively little specialized training and the number of

qualified applicants seeking entry jobs is sometimes large.

### Earnings and Working Conditions

According to a 1965-66 Bureau of Labor Statistics survey covering 221 metropolitan areas, shipping and receiving clerks earned an average of \$2.68 an hour. Average earnings were lowest in the Southern region, \$2.46 an hour, and highest in the Western region, where shipping and receiving clerks earned an average of \$2.91 an hour. Salary levels of shipping and receiving clerks in comparable jobs varied also, due to differences in the industries in which they were employed.

Shipping and receiving clerks generally work a 40-hour week. Many, when they work more than 40 hours, receive time and a half for overtime. Nightwork and overtime, including work on Saturdays, Sundays, and holidays, may be necessary when raw materials are needed immediately on factory production lines, when shipments have been unduly delayed in arriving, or in other emergencies.

Shipping and receiving clerks do much of their work in warehouses and shipping and receiving rooms; they may do some of it on outside loading platforms. Work places are often large, unpartitioned areas which may be drafty and cold, and littered with packing materials and containers.

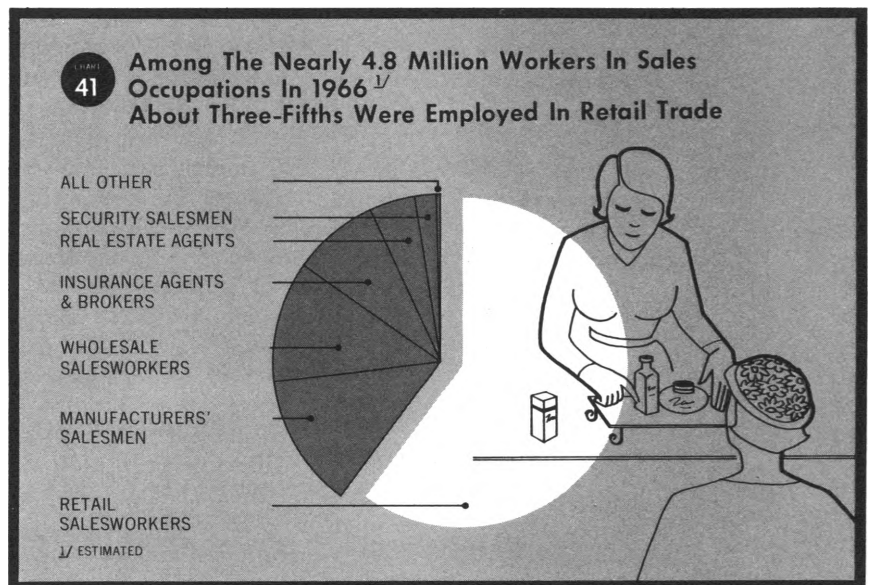
Some of the work done by shipping and receiving clerks requires physical stamina and strength. Most clerks must stand for long periods while they check quantities of merchandise. Locating numbers and descriptions on cartons often requires a great deal of bending, stooping, and stretching. It may be necessary for clerks to help load or unload shipments or move materials about in the warehouse. Occasionally, the work must be performed under considerable pressure in order to move shipments on time. (See introductory section of this chapter for Where To Go for More Information.)

## SALES OCCUPATIONS

Saleswork offers career opportunities for young people who have not completed high school as well as for those who have a college degree; for men and women who like to travel and those who do not; and for people who want salaried employment as well as those who aspire to run their own businesses.

Workers in this occupational group sell for manufacturers, insurance companies, and other producers of goods and services; for wholesalers who stock large quantities of goods so that smaller lots may be purchased and resold by retail stores; and for drugstores, dress shops, and other retailers who deal directly with the public. Their customers include housewives buying groceries, college students buying textbooks, and manufacturers and other businessmen purchasing such items as machine tools, office furniture, or stationery. A list of all salable items would be practically endless—shoes, steel, candy, and stocks and bonds, to name a few more examples.

Almost 4.8 million workers were employed in sales occupations in



1966. About one-fourth were part-time employees who usually worked fewer than 35 hours a week. Two out of every five were women, employed mainly in retail stores. In insurance, real estate, and other saleswork outside retail stores, the great majority of employees were men. Chart 41 shows the employment in the major sales occupations discussed in this

chapter. This chapter also includes individual statements for automotive salesworkers.

### Training, Other Qualifications, and Advancement

Training requirements for different kinds of saleswork—like the work it-

self—vary greatly. Thousands of salespersons have routine jobs selling standardized merchandise such as the magazines, candy, cigarettes, and cosmetics stocked by many drugstores. Similarly, the salesgirl behind the counter of a variety store needs to do little more than “wait on” people who have already made their selections from the stock displayed. Employers seldom require salespeople in such jobs to have specialized training. They usually learn their duties on the job as they work with experienced salesclerks or, in some large stores, they may attend brief training courses. Even in the most routine kinds of selling, however, a high school diploma is an asset to a beginner seeking a job. High school courses in business subjects, as well as the specialized courses in distributive education offered in some city school systems, are regarded by most employers as particularly good preparation for saleswork. The Federal Government also sponsors training for some salesworkers under provisions of the Manpower Development and Training Act.

The salesman who sells complex products or services—electronic equipment or liability insurance, for example—has a job which is altogether different from that of most retail salesclerks. Beginners on jobs of this kind sometimes receive training which lasts many months. For some positions, salesmen must be college graduates who have specialized in engineering or some other field. Other salesmen dealing in specialized services and products may acquire the necessary technical knowledge by taking courses offered at universities or by manufacturers. Still others gain knowledge through years of on-the-job experience, often supplemented by home study. Thus, a salesman of real estate may better qualify for his job by attending university extension courses; a beauty counselor in a department store may participate in an industry-sponsored training program before beginning her sales duties; or a salesman of fine jewelry may acquire his knowledge of gems during

years of observation and study as he works on the job.

Successful salespeople must have the ability to understand the needs and viewpoints of their customers, and a readiness to be of assistance to them. Saleswork also requires people with poise who are at ease in dealing with strangers. Other important attributes in many types of selling are energy, self-confidence, imagination, the ability to communicate well, and self-discipline. In almost all saleswork, except retail stores, the salesman must have the initiative to locate his own prospective customers and plan his own work schedule.

### Employment Outlook

During the rest of the 1960's and through the 1970's, employment in sales occupations is expected to rise moderately. Openings created by growth and vacancies which must be filled as salesworkers retire or stop working for other reasons are expected to result in a need for more than 275,000 workers each year; additional thousands of jobs will be needed to replace people now employed in saleswork who transfer to other types of employment.

As employment rises, the proportion of part-time workers—already higher than in most occupational groups—is also likely to increase. In the growing number of suburban shopping centers, particularly where many retail stores remain open for business several nights a week, a larger proportion of the sales force is likely to be made up of part-time workers employed only on Saturdays and during evening shopping hours.

The main reason for the anticipated rise in employment is the prospect of increased sales resulting from population growth, business expansion, and rising income levels. Within retail stores, however, special circumstances which have restricted employment growth in the recent past will probably continue to do so. Information about some of the special circumstances and the employment

prospects for salesworkers in retail stores and other major fields is given in the sections which follow. Factors affecting the demand for various sales occupations are also discussed in the sections which follow.

## SALESMAN AND SALESWOMEN IN RETAIL TRADE

(D.O.T. .260. through 298.877)

### Nature of Work

The success of any retail business depends largely on its salespeople. Courteous, efficient service from behind the counter or on the sales floor does much to satisfy customers and to build a store's good reputation. Aside from the contact with customers, which is a part of all sales jobs, there are differences in the duties, skills, and responsibilities of salespeople which are fully as great as the differences in the kinds of merchandise they sell.

In selling items such as furniture, electrical appliances, or some types of wearing apparel, the salesworker's primary job is to create an interest in the merchandise the store has to offer. The salesman or saleswoman may answer questions about the construction of an article, demonstrate its use, explain how it is cared for, show various models and colors, and otherwise help the customer to make a selection. In some stores, special knowledge or skills may be needed to sell the merchandise carried—for example, in a pet shop, information about the care and feeding of animals or, in a music store, the ability to play an instrument.

People who sell standardized articles, such as many of the items in hardware and drugstores, are called upon less frequently to give customers this kind of assistance. Often, they do little more than assemble and wrap the items purchased by each customer. In stores where goods are clearly labeled and arranged so that customers can easily make their se-

lections from shelves or counters—as in supermarkets and some drugstores—salesclerks may be replaced by cashiers who wrap or bag purchases, receive payment, and make change. (See statement on Cashiers.)

In addition to their selling duties, most retail salespeople make out sales or charge slips, receive cash payments, and give change and receipts. They also handle returns and exchanges of merchandise for the customer. Salespersons are usually responsible for keeping their work areas neat and presentable. In small stores, they may assist in ordering merchandise, stocking shelves or racks, marking price tags, taking inventories, and preparing attractive merchandise displays and promoting sales in other ways. (Route salesmen, who sell bread, milk, and other products directly to customers on a regular route, are discussed in the chapter on Driving Occupations.)

### Where Employed

Nearly 2.9 million salespersons—nearly three-fifths of them women—were employed in early 1967, in close to 100 different kinds of retail businesses. They worked in stores that range in size from the small drug or grocery store, which employs only one part-time salesclerk, to the giant department store with hundreds of salespersons. They also worked for door to door sales companies and mail order houses. The largest employers of salespersons are department and general merchandise, food, and apparel and accessories stores. Men predominate in stores selling furniture, household appliances, hardware, farm equipment, shoes, and lumber, and in automobile sales agencies. Women outnumber men in department and general merchandise, variety, apparel and accessories, and drugstores.

Sales jobs are found in practically every community in all parts of the country. However, the vast majority of salespersons work in large cities and in heavily populated suburban areas.



### Training, Other Qualifications, and Advancement

Employers generally prefer to hire high school graduates for sales jobs. Subjects such as salesmanship, commercial arithmetic, and home economics help to give the student a good background for many selling positions. Some high schools have distributive education programs, which include courses in merchandising, principles of retailing and retail selling, and also provide an opportunity for students to gain practical experience under trained supervision by working part time in local stores. Such part-time selling experience may be helpful in obtaining full-time employment.

Young people interested in obtaining sales jobs may apply to the personnel office in larger retail establishments. Applicants are interviewed and are sometimes required to take

special tests which indicate their aptitude for sales work. Among the characteristics preferred by employers are a pleasing personality, an interest in sales work, a neat appearance, and the ability to communicate clearly. Prospective salespersons should also be in good general health and able to stand for long periods of time.

Newly hired sales personnel usually receive on-the-job instruction to learn how to make out sales slips and operate the cash register. They learn about credit and other store policies and, if the products they sell require specialized knowledge, they may be given information of this kind also. In a great many small stores, new employees receive their training on the job under the close supervision of an experienced employee or the proprietor. In large stores, training programs are likely to be more formal, and beginners usually attend training sessions for a few days.

Executive positions in large retail businesses are often filled by promoting college graduates originally hired as trainees and assigned to sales jobs to gain practical experience. However, retail selling is one of the few fields in which an employee who has initiative and ability may be selected for promotion, regardless of his education. Many stores offer opportunities for persons without a college degree to advance to executive positions. Some salespersons eventually become buyers, department managers, or store managers; others, particularly in large stores, may transfer to office positions which afford opportunities for further promotion to administrative work in personnel, advertising, or other fields. Opportunities for advancement are relatively limited in small stores where one person, often the owner, performs most managerial functions. Retail sales experience is often a valuable asset in qualifying for jobs such as selling for wholesalers or manufacturers.

### Employment Outlook

A moderate increase is expected in the number of salespeople employed in retail sales occupations during the rest of the 1960's and through the 1970's. Openings created by growth and vacancies (which must be filled as salespersons retire or stop working for other reasons) are expected to total approximately 150,000 each year; additional thousands of jobs will become available as retail sales workers transfer to other types of employment.

Among the major factors contributing to the anticipated rise in retail sales jobs are population and economic growth, and the resulting increase in the volume of sales. The trend for stores to remain open for longer hours, although the number of weekly hours worked by salespersons continues to decline, will also contribute to the need for more salespersons. In addition to full-time sales jobs, there will be many opportunities for part-time workers, as well as for

temporary workers during peak selling periods, such as the Christmas season.

Changes in the way goods are sold are likely to limit the number of sales workers employed in some types of stores, and affect the kinds of openings that occur in others. Because self-service—already the rule in most food stores—is rapidly being extended to drug, variety, and other kinds of stores, customers will purchase more articles without the help of salespeople. On the other hand, rising income levels will probably increase the demand for some kinds of merchandise which requires the salesperson to spend a good deal of time with each customer: some examples are electrical appliances and automobiles, which prospective customers may want demonstrated. In view of these developments, it appears likely that sales employment will increase somewhat more slowly than the volume of sales. Little of the increase is likely to be in routine sales jobs; much of the demand will be for workers who are skilled in salesmanship and well informed about the merchandise they sell.

Sales workers have more stable employment than workers in many other occupations. When retail sales are affected by downturns in the economy, employers—particularly in large stores—can reduce the number of employees 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 scarce, however, because workers in other occupations often can qualify for sales work.

### Earnings and Working Conditions

In early 1967, young people starting in routine jobs where they were required to do little more than "wait on" customers, were generally paid \$1.40 an hour (in many establishments, the minimum wage required by law). In stores where salesmanship is more important, starting salaries were sometimes higher than this, or,

in small establishments not covered by the minimum wage law, somewhat lower. Salaries are usually lower in rural than in metropolitan areas.

Experienced salesworkers, including those whose pay scales are determined by union contracts, often earn \$2 or more an hour. Many are paid on a straight salary basis; some also receive commissions—that is, a percentage of the sales they make; and still others are on a straight commission basis. Earnings are likely to be highest in jobs which require special skill in dealing with customers, or technical knowledge of the merchandise sold. Among the highest paid are people who sell automobiles, major appliances, and furniture.

Salespersons in many retail stores are allowed to purchase merchandise at a discount, often from 10 to 25 percent below regular prices. This privilege is sometimes extended to the employee's family. Some 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.

Some full-time salespersons work a 5-day, 40-hour week, although in many stores, the standard workweek is longer. Some stores are required by law to pay overtime rates for more than 40 hours' work a week. Since Saturday is a busy day in retailing, employees usually work that day and have another weekday off. Longer than normal hours may be scheduled before Christmas and during other peak periods, and employees who work overtime receive additional pay or an equal amount of time off during slack periods. Some salespersons regularly work one evening or more a week, especially in stores in suburban shopping centers.

Part-time salespersons generally work during the store's peak hours of business—daytime rush hours, evenings, and weekends.

Salespeople in retail trade usually work in clean, well-lighted places. Many stores are air conditioned. Some sales positions require work

outside the store; a salesman of kitchen equipment may visit prospective customers at their homes, for example, in order to assist them in planning renovations, and a used-car salesman may spend much of his time working at an outdoor lot.

### Where To Go for More Information

Information on retailing courses given in high schools may be obtained from local Superintendents of Schools, or from the State Supervisor of Distributive Education in the Department of Education at each State capital.

Additional information on careers in retailing may be obtained from the personnel offices of local stores; from merchants' associations; or from local unions of the Retail Clerks International Association.

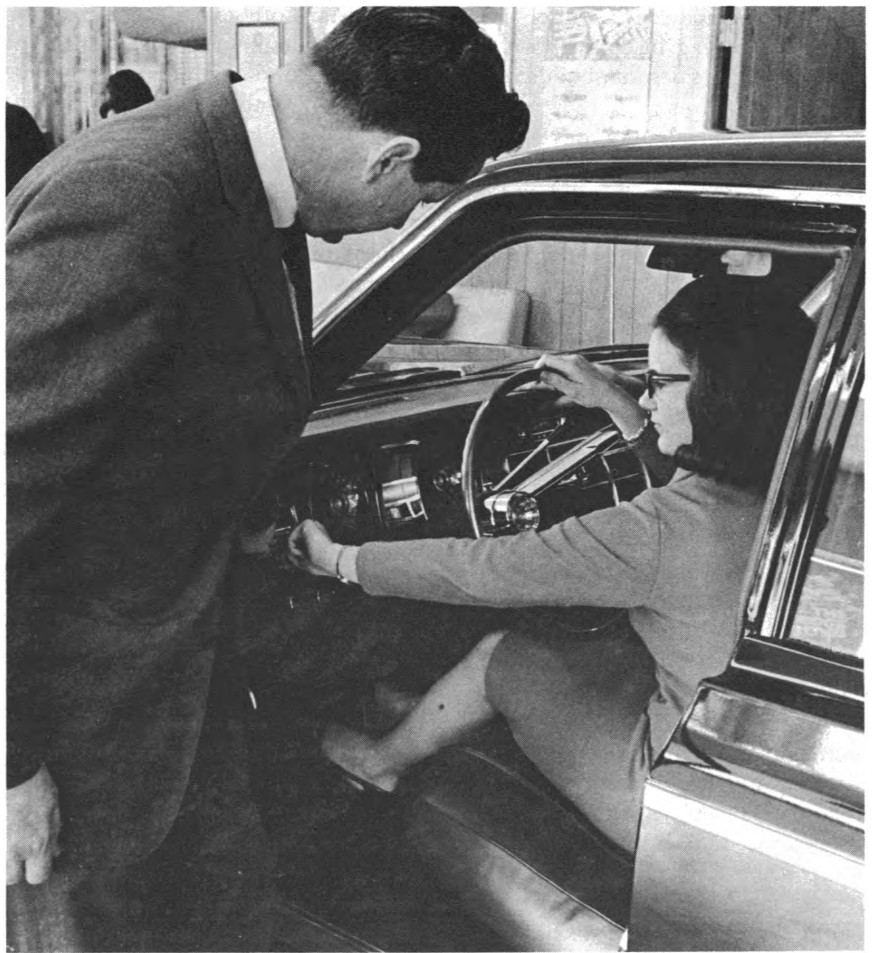
## AUTOMOBILE SALESMEN

(D.O.T. 280.358)

### Nature of Work

Automobile salesmen are important links between the makers and buyers of new cars, and between used-car dealers and buyers. Many salesmen sell only new or used cars. Others sell both new and used cars, as well as trucks. (This statement does not discuss salesmen who sell trucks only.)

The automobile salesman spends much of his time waiting on customers in the dealer's showroom or used-car lot. After greeting a customer, he finds out the kind of car the customer has in mind, and the features that interest him most, by asking questions and encouraging him to comment on the cars on display. For example, one customer may indicate that he is primarily interested in economy and ease of operation, but another may be more impressed with styling and performance. In his sales presentation, the salesman emphasizes the points that will satisfy the customer's needs



Automobile salesman explains controls to customer.

and stimulates his desire to buy. For example, if the customer is interested in a compact car, the salesman may stress economical gas mileage and low cost and upkeep. To illustrate such features as smoothness of ride and ease of operation, he invites the customer to test drive the car.

Because the purchase of a car involves a considerable sum of money, most customers must be thoroughly convinced that they are making a wise decision. Successful salesmen have the ability to overcome the customer's hesitancy to buy and get the order (called closing the sale). Since closing the sale frequently is difficult for beginning salesmen, experienced salesmen or sales managers often lend assistance. Salesmen may quote tentative prices and trade-in allowances

when conferring with customers, but these figures are usually subject to the approval of sales managers. Salesmen may arrange financing and insurance on the cars they sell. They also register cars and obtain license plates for customers.

Before the salesman approves delivery of a car, he makes sure that it has been properly serviced and has the accessories specified by the customer. He answers the customer's questions on subjects such as the car's controls and the maintenance warranty. A week or so following delivery of the car, he may contact the customer by phone or mail to express appreciation for the customer's business and to inquire about his satisfaction with the car. From time to time, he may also send the customer brochures

on new-car models and other literature. By keeping in contact with his customers, the salesman builds repeat business.

Automobile salesmen develop and follow leads on prospective new customers. For example, they obtain names of prospects from sources such as automobile registration records and dealer sales, service, and finance records. A salesman also can get leads on prospective customers from gasoline service station operators, parking lot attendants, barbers, and others whose work brings them in contact with large numbers of people. He also may contact prospects by phone or mail.

### Where Employed

An estimated 110,000 automobile salesmen were employed in late 1966. More than four-fifths of automobile salesmen are employed by new-car dealers, and the remainder work for used-car dealers. Although many used-car dealers employ only 1 salesman, some new-car dealers employ more than 50 salesmen. Some used-car dealers do not employ salesmen or employ them on a part-time basis only.

Automobile salesmen can find employment opportunities throughout the country, although most opportunities are in large urban areas and in the most populous States.

### Training, Other Qualifications, and Advancement

Most beginning salesmen are trained on the job by sales managers and experienced salesmen. In many large firms, they also receive formal training in special classes for beginners before they start selling. These classes, which generally last for several days, include instruction on obtaining customer leads, making sales presentations, and closing sales. Beginners frequently are given training manuals and other educational material published by automobile manu-

facturers. Both experienced and beginning salesmen receive continuing guidance and training from sales managers, both on the job and at periodic sales meetings. Salesmen also may attend training programs offered by automobile manufacturers.

Most sales managers regard a high school diploma as the minimum educational requirement for beginning automobile salesmen. A growing number of automobile salesmen have completed a few years of college. Courses in public speaking, commercial arithmetic, English, business law, psychology, and salesmanship provide a good background for selling. Previous sales experience or work requiring contact with the public is helpful. Many automobile salesmen have been furniture salesmen, route salesmen, door-to-door salesmen, automobile parts counter men, or gasoline service station attendants. However, many sales managers will hire applicants who have little or no sales experience if their personal and educational qualifications are satisfactory.

Age requirements for beginning salesmen vary among employers, although many prefer that beginners be at least in their mid- or late twenties. Age requirements sometimes are waived if the employer considers the applicant to be a mature individual. However, most employers consider 21 years as the minimum age for beginning salesmen.

Automobile salesmen must be tactful, well groomed, express themselves well, and have the other personal qualities that make a good impression on customers. Initiative and aggressiveness are also important because the number of sales is related to the number of prospective customers contacted. Because automobile salesmen occasionally have the discouraging experience of going for days without making a sale, they need self-confidence and determination to get through these slow periods.

Successful salesmen who have managerial ability may advance to assistant sales manager, sales manager, or general manager. Some sales man-

agers and general managers who acquire the necessary capital eventually acquire their own dealerships or become partners in dealerships.

### Employment Outlook

Many thousands of job openings for automobile salesmen are anticipated each year through the 1970's. Most of these openings are expected to result from the need to replace automobile salesmen who transfer to other fields of work. Although selling cars is a rewarding career for many young people, others find that they are not suited for the work and leave to seek other jobs. In addition to employment opportunities resulting from transfers out of the occupation, an estimated 2,000 openings will arise annually because of the need to replace experienced salesmen who retire or die.

In addition to replacement needs, the number of automobile salesmen is expected to grow moderately, because of the expanding demand for cars. Annual sales of new and used cars will rise during the next decade as a result of rising population, family formations, multicar ownership, personal income, and the continuing growth of suburbs. Car sales have fluctuated from year to year in the past with changes in general business conditions, consumer preference, and the availability of credit. Employment of automobile salesmen also has fluctuated, but has tended to be more stable than sales.

### Earnings and Working Conditions

Almost all automobile salesmen are paid on a commission basis. Commissions usually are based on the selling price of a car or the gross profit received by the dealer. Additional commissions may be paid when cars are financed and insured through the dealer. Although salesmen work year-round, their sales (and their commissions) may vary from month to



month. To provide commission salesmen with a steady income, many dealers pay a modest weekly or monthly base salary. Others advance salesmen money against their future commissions. A few dealers pay their salesmen a straight salary. Dealers may guarantee beginners a modest income for a few weeks or months. Thereafter, they are paid on the same basis as the more experienced salesmen.

Automobile salesmen had average weekly earnings of \$161 in 1965, according to a survey of automobile dealerships conducted by the National Automobile Dealers Association. Earnings varied widely, depending on factors such as individual ability and experience, geographic location, and the size of the dealership. For example, salesmen employed by dealers that sold between 100 and 149 new cars and trucks in 1965 had average weekly earnings of \$132, while those employed by dealers that sold 1,000 or more had average weekly earnings of \$195.

A large number of employers furnish salesmen with demonstrator cars free of charge. Others allow salesmen to buy or lease them at a discount, often at dealer's cost. Salesmen also receive discounts on cars bought for their personal use. Most dealers provide paid vacations. Many provide life insurance, hospitalization, and surgical and medical insurance.

Most automobile salesmen work 6 days a week. Because many customers find it more convenient to shop after work, salesmen frequently work evenings. In some areas, they may work on Sundays and take a day off during the week. Many dealers assign salesmen "floor-time"—hours they spend in the showroom greeting customers. For example, a salesman may be scheduled to work on the showroom floor from 9 a.m. to 3 p.m. one week, from 3 p.m. to 9 p.m. the next week, and all day on Saturdays. When not assigned to the floor, salesmen may spend a few hours each day delivering cars to customers and looking for new customers. Many salesmen work more than 50 hours a week.

### Where To Go for More Information

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

## AUTOMOBILE PARTS COUNTERMAN

(D.O.T. 289.358)

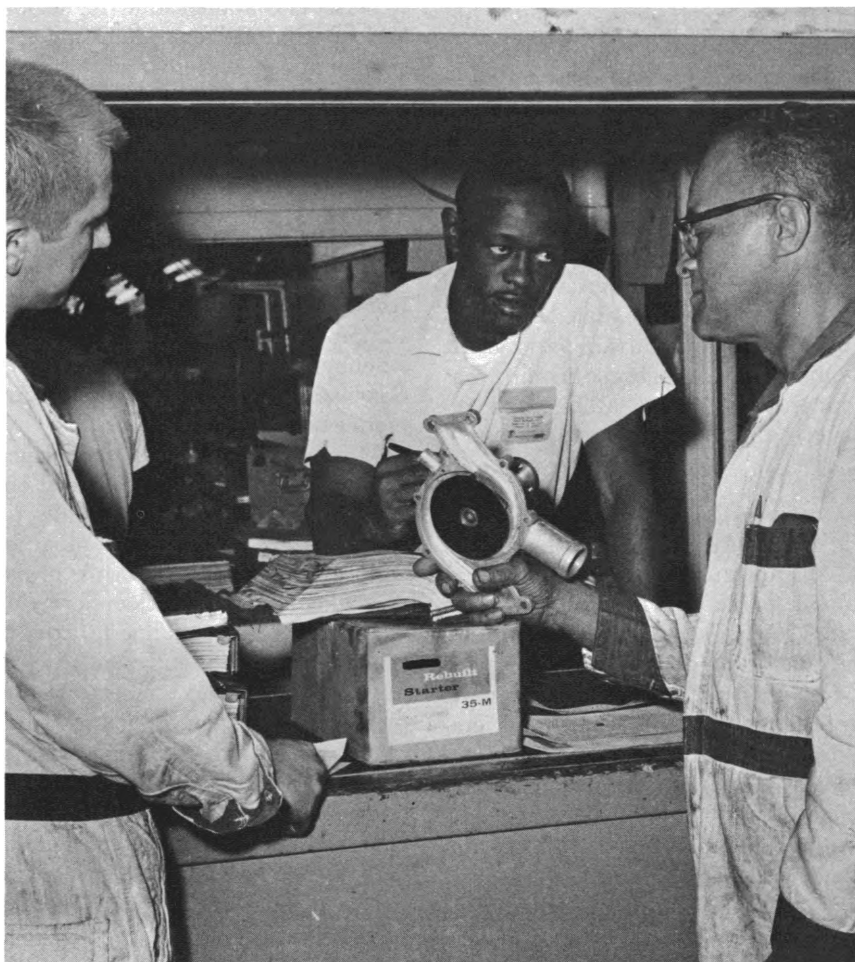
### Nature of Work

Automobile parts countermen sell replacement parts and accessories for automobiles, trucks, and other motor vehicles. Most of them work in automobile parts wholesale stores and automobile dealer parts departments, where they sell directly over the counter and take telephone orders for

varied items such as piston rings, head gaskets, shock absorbers, rear-view mirrors, and seat covers.

Parts countermen employed by wholesalers sell parts for many different makes of automobiles and trucks to independent repair shops, self-employed mechanics, service station operators, "do-it-yourselfers," and other customers. Parts countermen employed by automobile and truck dealers usually sell only parts used on the particular makes of automobiles and trucks sold by the dealers. They may spend most of their time supplying parts to mechanics employed by the dealer.

A parts counterman identifies the part the customer needs—often, only on the basis of a general description—and locates the part in the stockroom. By knowing how to use parts cata-



Automobile parts counterman dispenses part to mechanic.

logs and by knowing the layout of the stockroom, he readily can find any one of several thousand items. If a customer needs a part that is not stocked, the parts counterman may suggest one that is interchangeable, place a special order for the part, or refer the customer elsewhere.

The parts counterman determines the prices of parts by referring to price lists, receives cash payment or charges the customer's account, fills out sales receipts and, when necessary, packages the item sold.

In addition to their sales duties, parts countermen may keep catalogs and price lists up to date, order parts to replenish stock, unpack incoming shipments of parts and distribute them in the stockroom, maintain sales records, and take inventories. In many large wholesale stores, some of these nonselling duties are performed by workers such as stock clerks and receiving clerks.

Parts countermen may use micrometers, calipers, fan belt measurers, and other devices to measure parts for interchangeability. They may also use coil condenser testers, spark plug testers, and other types of testing equipment to determine whether parts are defective. In some stores—particularly in small wholesale establishments—they may repair parts, using equipment such as brake riveting machines, brake drum lathes, valve refacers, and engine head surfacers.

### Where Employed

Most of the estimated 61,000 automobile parts countermen employed in late 1966 worked for automobile dealers and automobile parts wholesalers. Most dealers employed 1 to 4 parts countermen; many wholesalers employed more than four. Other employers of these workers include truck dealers, retail automobile parts stores, automobile parts and accessories departments of department stores, and warehouse distributors of automobile parts. Trucking companies and buslines employ some parts countermen to maintain stockrooms and dispense

parts to the mechanics who repair their fleets.

Parts countermen can find jobs throughout the country in automobile dealerships and automobile parts wholesale stores. Parts countermen who work for warehouse distributors, department stores, trucking companies, and buslines are employed mainly in large towns and cities.

### Training, Other Qualifications, and Advancement

Automobile parts countermen should have a knowledge of the different types of motor vehicle parts and their functions and an aptitude for working with numbers. They should be neat, friendly, even-tempered, and tactful because they deal with many different types of customers. The ability to write legibly and concentrate on details, plus a good memory, are also desirable qualifications. High school or vocational school courses in subjects such as automobile mechanics, commercial arithmetic, salesmanship, and book-keeping are helpful to young men interested in becoming parts countermen. Practical experience gained from working in a gasoline service station or working on automobiles as a hobby is also helpful. For entry jobs, employers generally prefer to hire high school graduates.

Most automobile parts countermen learn the trade through informal on-the-job training. Beginners usually are hired as parts delivery men or trainees. In some large firms, beginners start as stock clerks or receiving clerks. The trainee gradually acquires a knowledge of the different types of parts, learns how to use catalogs and price lists, and memorizes the layout of the stockroom. Although trainees may start waiting on customers after a few months' experience, it generally takes about 2 years to become a qualified parts counterman.

Automobile parts countermen with supervisory and business management capabilities may become parts department or store managers. Others may

become "outside salesmen" for parts wholesalers and distributors. These salesmen call on automobile repair shops, service stations, trucking companies, and other businesses that buy parts and accessories in large quantities.

### Employment Outlook

Employment of automobile parts countermen is expected to increase moderately through the 1970's. In addition to the job opportunities resulting from employment growth, an estimated 1,300 job openings are expected each year as a result of the need to replace experienced workers who retire or die. Job openings also will occur as some parts countermen transfer to other lines of work.

Continued growth in the employment of parts countermen is anticipated because more replacement parts will be needed to maintain the increasing number of motor vehicles in use. Moreover, the variety of replacement parts is growing. In recent years, automobile manufacturers have offered consumers a greater selection of makes and models, and optional equipment. As a result, automobile dealers and parts wholesalers are selling a much larger variety of parts, although many parts are interchangeable among various models. Employment in this occupation is expected to increase despite the fact that more and more replacement parts are being sold by retail outlets that do not employ parts countermen.

### Earnings and Working Conditions

In addition to a regular salary, automobile parts countermen receive commissions based on sales. Inexperienced men beginning as trainees, deliverymen, or stock clerks generally receive \$60 to \$80 a week. Experienced parts countermen employed by automobile dealers had estimated straight time hourly earnings of \$2.85 in late 1966. Those who worked for wholesalers had comparable earnings.

Most parts counter men work between 40 and 48 hours a week. In many firms, they work half a day on Saturday.

Many employers of parts counter men provide paid holidays and vacations, and pay part or all of additional benefits such as life, health, and accident insurance. Others also contribute to retirement plans.

Stock rooms are usually clean and well lighted. The work of parts counter men is not physically strenuous, but they are on their feet much of the time and do a lot of walking. They frequently have to work rapidly when waiting on more than one customer and simultaneously answering telephone calls.

Unions organizing automobile parts counter men include the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

### Where To Go for More Information

For further information regarding work opportunities for automobile parts counter men, inquiries should be directed to local employers, such as automobile dealers and automobile parts wholesalers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also can provide information about the Manpower Development and Training Act of 1962 and other programs that provide opportunities for training.

General information about the work of automobile parts counter men may be obtained from:

Automotive Service Industry Association,  
168 North Michigan Ave., Chicago,  
Ill. 60601.

National Automotive Parts Association,  
29 East Madison St., Chicago, Ill.  
60602.

## AUTOMOBILE SERVICE ADVISORS

(D.O.T. 620.281)

### Nature of Work

Many automobile dealers and some large independent garages employ service advisors to wait on customers who bring their automobiles in for maintenance and repairs. The automobile service advisor (sometimes called *service salesman* or *service writer*) is the link between the customer and the automobile mechanic. He confers with the customer to determine his service needs and arranges for a mechanic to do the work.

Many times, such as when requests are made for a routine checkup, the advisor merely writes the customer's requests for services on a repair order.

However, when the customer complains of mechanical or electrical trouble, the service advisor may have to ask him about the nature of the trouble and test drive the automobile. For example, if the customer says his automobile is difficult to start, the service advisor may try to determine if the trouble occurs when the engine is cold or after it has warmed up. The service advisor writes a brief description of these symptoms on the repair order. Such information is helpful to the mechanic in determining the cause of the trouble. The advisor also records other information on the repair order, including identification of the customer and his automobile. If the repairs are covered by a factory warranty, he records the automobile engine and body numbers, and the automobile's mileage and purchase date.



Service advisor records customer's maintenance needs.

The service advisor tells customers what repairs are needed and their approximate cost. He also tells them how long the work will take. He may advise on the necessity of having work done, by pointing out that it will assure improved performance and safer operation, and prevent more serious trouble. In addition to advising on service needs, he may also sell automobile accessories. For example, while talking with customers, the service advisor may suggest the purchase of air-conditioners, radios, and seat covers.

If the service advisor is unable to tell the customer what repairs are needed until a mechanic has inspected the automobile, he takes the customer's phone number and contacts him later to obtain permission to make the necessary repairs.

The service advisor gives the repair order to the shop dispatcher who in turn usually computes the cost of repairs and assigns the work to a mechanic. In some shops, service advisors may compute the cost of repairs. If the mechanic has questions concerning the repair order, he contacts the service advisor. After the mechanic has completed the repair work, the service advisor may test drive the automobile to assure that the problem has been corrected.

When the customer returns for his automobile, the service advisor answers any questions regarding the repairs and tactfully deals with any complaints about their cost or quality. If the automobile is to be returned to the shop because the customer is dissatisfied with the work, or the cost of repairs is to be adjusted, the service advisor must usually obtain the authorization of his supervisor, the service manager. In some dealerships, the most experienced service advisor substitutes for the service manager when he is absent.

### Where Employed

An estimated 10,000 automobile service advisors were employed in late 1966. Most of them worked for large

automobile dealers that employed from one to four service advisors. Service advisors are employed by comparatively few small automobile dealers. Some service advisors are employed by large independent automobile repair shops.

### Training, Other Qualifications, and Advancement

Service advisors are trained on the job under the guidance of experienced service advisors and the service manager. In many shops, the trainee's first assignment is to assist the service department dispatcher or cashier for a few weeks. By working with the dispatcher, he learns how repair orders are routed through the shop, how long it takes to complete different types of repairs, and how to compute repair costs. At the cashier's counter, he learns the costs of different types of repairs and how experienced service advisors handle customer complaints. The beginner can usually become a qualified service advisor in 1 to 2 years, although it may take longer if his duties include estimating automobile-body repairs.

Employers typically promote qualified young men from within their own organization when vacancies for service advisor trainees arise. For example, a young man may apply for a job as service advisor trainee after he has gained experience in the firm as an automobile mechanic trainee or parts counterman trainee.

For service advisor trainees, employers prefer high school graduates who are over 21 years of age and have had some work experience in automobile repair or related activities. Some employers hire only qualified automobile mechanics. A driver's license is usually a requirement. Because he is likely to be the only employee who deals directly with the customer, the way the service advisor does his job is very important in establishing customer satisfaction. Therefore, employers look for applicants who are neat, courteous, even-tempered, attentive listeners, and

good conversationalists. High school and vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, public speaking, and English are helpful to young men interested in becoming service advisors.

Service advisors with supervisory ability may advance to the position of service manager. Some service advisors open their own automobile repair shops.

### Employment Outlook

Employment of automobile service advisors is expected to increase rapidly through the 1970's as a result of the increasing number of automobiles in use. However, because this is a relatively small occupation, only a few hundred new service advisor jobs will be added annually. In addition to the job opportunities resulting from employment growth, a few hundred job openings will result annually because of the need to replace experienced service advisors who retire, die, or transfer to other fields of work.

The number of automobiles registered in the United States is expected to rise because of increases in population, new families, consumer purchasing power, and multicar ownership. The growing number of automobiles and their increasing complexity will result in additional repair work; consequently, many automobile dealers will need additional service advisors. Also, some small dealers, who do not employ service advisors now, are expected to hire them because of increases in the volume of service work.

### Earnings and Working Conditions

Most service advisors are paid a salary plus a commission. The commission usually is based on both the labor cost of repairs and the price of accessories sold. Some service advisors are paid a fixed salary or a straight commission. Service advisors' commission earnings may vary as a result

of fluctuations in the volume of repair work. Experienced service advisors employed by automobile dealers had estimated straight-time hourly earnings of \$3.61 in late 1966.

Many employers of service advisors provide paid holidays and vacations, and pay all or part of the cost of life, or health and accident insurance. Others also contribute to retirement plans. Laundered uniforms are furnished free of charge by many employers.

Most service advisors work from 40 to 48 hours a week. They are busiest in the early morning, when most customers bring their cars in for repairs, and in late afternoon, when they return for them. During these peak hours, some advisors may be rushed to wait on customers.

Service advisors are on their feet much of the time and may have to be outdoors in all kinds of weather, but their work is not physically strenuous. Occasionally, they also have to deal with disgruntled customers, but most of their contacts with customers are pleasant.

Unions that organize service advisors include the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

### SALESMEN IN WHOLESALE TRADE

(D.O.T. 260. through 289.458)

#### Nature of Work

Salesmen in wholesale trade play an important part in the movement of goods from the factory to the consumer. Each salesman may represent a company that assembles and distributes hundreds—sometimes thousands—of similar products. A wholesale drug company, for example, may stock its warehouse with many brands of drugs, soaps, and cosmetics to sup-



Wholesale salesman gives customer explanatory material on new product.

ply drug, variety, and other stores that sell directly to the consumer. In much the same way a wholesale building materials dealer sells hardware and construction materials to builders who would otherwise have to deal with many manufacturers.

At regular intervals, the salesman visits buyers for retail, industrial, and commercial firms, as well as those for institutions such as schools and hospitals. He shows them samples, pictures, or catalogs listing the items his company stocks. The salesman seldom urges customers to purchase any particular product, since he handles a very large number of items; his objective is to persuade buyers to become regular customers of the wholesale firm he represents. His success depends on establishing a good reputation by keeping his customers well supplied at all times and otherwise giving prompt and dependable service.

Wholesale salesmen render a variety of special services which are becoming an increasingly important part of their job. Retailers sometimes depend on them to check the store's stock and prepare orders for items which will be needed before the next visit. In addition, salesmen often advise retailers how to advertise new products, what prices to charge, and how to arrange window and counter displays. A salesman of specialized

products—for example, air-conditioning equipment—may give technical assistance on problems such as installation and maintenance.

Salesmen are responsible for some paper and detail work. They must write orders and send them to the wholesale house, prepare expense accounts and reports, plan their work schedule, make appointments, compile lists of prospects, and study literature relating to the products they sell. Some salesmen also collect the money owed to their companies.

#### Where Employed

More than 550,000 salespeople—about 95 percent of whom were men—worked for wholesalers in 1967.

Wholesale houses are located mainly in cities, but the territories assigned to their salesmen may be in any part of the country. A salesman's territory may cover a small section of a city with many retail stores and industrial users, or, in less populated regions, it may cover half a State or more.

Leading employers of wholesale salesmen are companies that sell foods and food products. Other large employers are wholesalers dealing in drugs, dry goods and apparel, motor vehicles and equipment, and electrical appliances and other items for home use, or those who sell products such as machinery and building materials for use by industrial and business firms.

#### Training, Other Qualifications, and Advancement

In hiring trainees for sales work, most wholesalers look for young men with friendly, outgoing personalities. Other traits helpful to salesmen include self-confidence, enthusiasm for the job, and an understanding of human nature. High school graduation is the usual educational requirement, although many companies selling technical and scientific products such as heating and air-conditioning equipment, medical supplies, and electronic

equipment prefer men with specialized training beyond high school.

A prospective salesman may begin his career with a wholesale firm in a nonselling job, or he may be hired as a sales trainee. In either case, the beginner usually must work in several kinds of nonselling jobs before being assigned as a salesman. He may begin in the stockroom or shipping department, where he becomes familiar with the thousands of items the wholesaler carries. Later, he may transfer to the pricing desk to learn the prices of articles and discount rates for goods sold in quantities. Next, he is likely to become an "inside salesman," writing orders that come from customers by telephone. In this job, and later as he accompanies an experienced salesman on his calls, the trainee comes to know many of the firm's customers. The amount of time spent in these initial jobs varies among companies; it usually takes 2 years or longer to prepare the trainee for outside selling. Only after he has become familiar with the company's products and the proper techniques of selling is he assigned a territory of his own.

Experienced salesmen with the necessary leadership qualities and sales ability may advance to supervisory and managerial jobs in the sales field or to other executive positions in wholesale firms.

### Employment Outlook

Employment opportunities for salesmen in wholesale trade are expected to be good during the rest of the 1960's and through the 1970's. In addition to new positions which will be created as a result of growth in the field, thousands of job openings will occur each year as salesmen retire, die, or enter other types of employment. Retirements and deaths alone may result in more than 10,000 job openings annually. Additional openings will arise as workers transfer to other kinds of work; a sizable amount of turnover occurs among new entrances.

The number of wholesale salesmen is expected to rise moderately, mainly because the amount of business transacted by wholesale houses is expected to increase as the population and the economy expand. It is probable also that in the next decade, wholesale salesmen will be spending an increasing proportion of their time rendering special services to customers—advising about displays and assisting in other ways—and this in turn will add to the need for sales personnel. As chain stores and other large business firms continue to centralize their purchasing activities, the value of the sales which wholesalers make to individual customers will become larger and competition for sales correspondingly greater. To meet this competition, wholesalers can be expected to place an increasing amount of emphasis on sales activities.

### Earnings and Working Conditions

According to the limited information available, most junior or beginning salesmen earned around \$7,200 a year in 1966. Experienced salesmen generally earn much more. Many salesmen make considerably more than \$10,000 a year.

Most employers pay a salary plus a commission which is a percentage of the dollar sales of each salesman; others pay a straight commission. Practically all wholesale salesmen have steady year-round work; but their sales (and their commissions) vary from month to month because the demand for some things—for example, air-conditioning equipment or apparel—is greater during certain seasons than others. To provide salesmen with a steady income regardless of how sales fluctuate from one month to another, it is becoming increasingly common for companies to pay their experienced salesmen, at regular intervals, a "draw" against the commissions they can be expected to earn annually. Most companies provide each salesman with a car, or an allowance if he uses his own car, and re-

imburse him for certain expenses on the road.

The salesman often works long, irregular hours. He calls on customers when they are open for business and, if his territory is large, he may travel at night or on weekends to meet his schedule. However, most salesmen are seldom away from their homes for more than a few days at a time. Many of their evenings may be spent writing reports and orders. Salesmen generally carry heavy catalogs and sample cases and are on their feet for long periods of time.

Most salesmen have paid vacations of from 2 to 4 weeks, depending on length of service with their employers. Some are covered by company benefit programs, including health and life insurance and retirement benefits.

### Where To Go for More Information

Information on jobs in 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,  
1725 K St. NW., Washington, D.C.  
20006.

### MANUFACTURERS' SALESMEN

(D.O.T. 260. through 289.458)

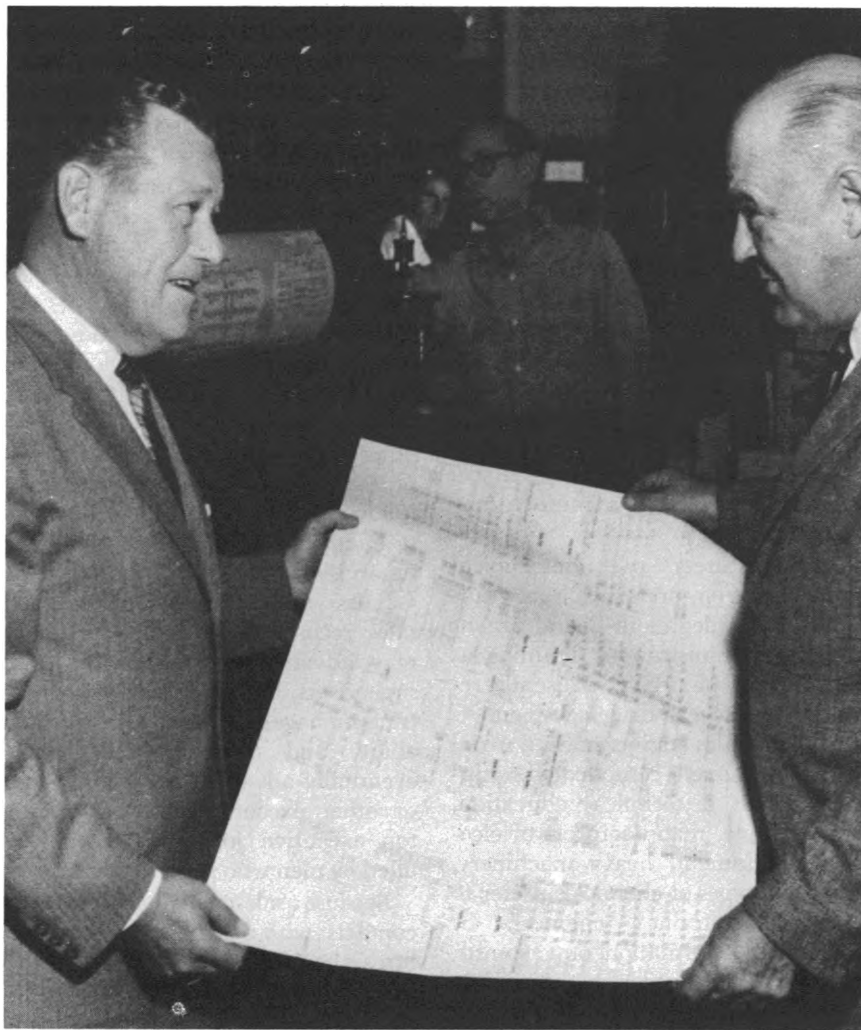
#### Nature of Work

Practically all manufacturers—whether they make electronic computers or everyday can openers—employ salesmen. Manufacturers' sales representatives sell mainly to other businesses—factories, railroads, banks, wholesalers, and retailers; they also sell to hospitals, schools, and other institutions. The manner in which they go about this depends to a large extent on whether they are selling technical products such as factory machinery, metals, or chemicals, or non-technical products such as clothing, canned foods, or stationery.

The great majority of manufacturers' salesmen sell nontechnical products—chiefly to wholesalers, less often to big retail stores. Salesmen in this kind of work must be well informed about their firms' products—which sometimes number in the hundreds—and also about the special requirements of their customers. When a salesman visits firms in his assigned territory, he uses a sales approach adapted to the particular line of merchandise he carries. Thus, a salesman of crackers or cookies may emphasize the wholesomeness of his manufacturer's products, the attractive way they are packaged, and the many kinds available. A clothing salesman, on the other hand, may stress style, design, fabrics, and the details of manufacture. Sometimes salesmen promote sales of their companies' products by setting up displays in hotels and holding conferences with wholesalers and other customers.

A salesman of highly technical products—electronic equipment, for example—is often called a *sales engineer* or an *industrial salesman*. In addition to having a thorough knowledge of his firm's products and the art of selling, he must be able to help prospective buyers with technical problems. For example, he may spend days or weeks analyzing a firm's manufacturing problems in order to determine the kinds of equipment and materials best suited to its operation. He then presents his solution to company officials—usually department heads or other executives—and tries to negotiate the sale. Often, sales engineers work with the research and development departments of their own companies, devising ways to adapt products to a customer's specialized needs. Salesmen of technical products sometimes train their customers' employees in the operation and maintenance of new equipment, and make frequent return visits to be sure that it is giving the desired service.

Although manufacturers' salesmen spend most of their time visiting prospective customers, they also do some paperwork. They must write



Manufacturer's salesman provides technical assistance to customer.

sales reports, plan their work schedules, make appointments, compile lists of prospects, conduct some sales correspondence, make out expense accounts, and study literature relating to their products. They may also be required to write reports on sales prospects in their territories, or on their competitors' products or customers' credit ratings.

#### Where Employed

More than 625,000 manufacturers' salesmen were employed in 1967; over 40,000 were sales engineers in manufacturing industries. Some manufacturers' salesmen work out of

company "home offices," which are often located at manufacturing plants. The majority, however, work out of branch sales offices, which are usually in big cities where the greatest numbers of prospective customers are found.

More salesmen work for companies which produce food products than for any other industry. Other industries employing large numbers of salesmen include printing and publishing firms and manufacturers of chemicals, fabricated metal products, and electrical and other machinery. The largest employers of sales engineers are companies producing transportation equipment, fabricated metal products, and heavy machinery.

About 10 percent of all manufacturers' salespeople are women, most of whom are employed in industries producing food products.

### Training, Other Qualifications, and Advancement

College graduates are sometimes preferred for training as salesmen, because certain employers find that a college education is helpful in dealing with company officials. However, many persons with little or no training beyond high school who are well qualified in other respects can achieve successful careers as manufacturers' salesmen.

Manufacturers of nontechnical products often prefer college graduates with a degree in liberal arts or business administration. Training at a college of pharmacy is usually required for jobs as drug salesmen. As a rule, the sales engineer or industrial salesman who sells complicated equipment needs a technical education. For example, manufacturers of electrical equipment, heavy machinery, and some types of chemicals prefer to hire college-trained engineers or chemists. (Information on chemists, engineers, and other professionally trained workers who may be employed as industrial salesmen is given elsewhere in the *Handbook*.)

Although prospective salesmen can often get jobs by applying directly to sales offices or manufacturing concerns, many are recruited by manufacturers who send representatives to colleges to interview students who will soon graduate. Recruiters look for students who are academically well qualified and who have participated in extracurricular activities. As salesmen, they must be able to meet and get along well with many types of people. Recruiters also consider the student's personality traits and appearance. Preference is likely to be given to those with pleasant but forceful personalities who make a favorable impression in manner, speech, and dress. A recruiter may hire directly for his company or he may ar-

range for those applicants he feels are qualified to be interviewed by company officials before final selections are made.

Most beginning salesmen are given some training before they start on the job. Some companies, especially those manufacturing complex technical products, have formal training programs lasting 2 years or longer. In some of these programs, trainees are rotated among jobs in several departments of the plant and office to learn all phases of production, installation, and distribution of the product; other trainees receive formal instruction in classes at the plant, sometimes followed by intensive on-the-job training in a branch office under the supervision of field sales managers.

Sales representatives with good sales records and leadership ability may advance to positions as sales supervisors, branch managers, or district managers. Those with unusual ability and managerial skill may eventually advance to sales manager or other executive positions; many top executive jobs in industry are filled by men who started as salesmen.

Because salesmen have frequent contacts with businessmen in other firms, they often find opportunities to transfer to better jobs with companies to which they sell products. Some salesmen go into business for themselves as manufacturers' agents selling similar products of several manufacturers. Experienced salesmen often find opportunities in advertising, market research, and other fields related to selling.

### Employment Outlook

Employment opportunities for manufacturers' salesmen are expected to be very good during the remainder of the 1960's and through the 1970's. More than 30,000 openings will occur annually as employment in this occupation rises and as existing jobs become vacant due to retirement or death. Still other vacancies will occur as salesmen leave their jobs to enter other types of employment.

The number of manufacturers' salesmen is expected to rise rapidly, partly because of general economic growth, and also because manufacturers will be placing greater emphasis on their sales activities. The development of new products and improvements in marketing techniques will probably heighten competition between the manufacturers. With the increase in the volume of business transacted with some customers—modern industrial complexes, chain store organizations, and large institutions of many kinds—competition between the manufacturers supplying these organizations will further the need for effective sales organizations. Despite the fact that they will be filling thousands of sales jobs each year, manufacturers are expected to be selective in hiring. They will look for ambitious young people who are both well trained and temperamentally suited for their jobs. As markets for technical products expand, demand is likely to be particularly strong for the technically trained salesmen.

### Earnings and Working Conditions

According to the limited data available, starting salaries for beginning salesmen averaged about \$7,000 a year in 1966. With commissions and bonuses included, most salesmen earned more than this amount annually. The highest starting salaries were generally paid by manufacturers of electrical and electronic equipment, construction materials, hardware and tools, and scientific and precision instruments.

Some manufacturing concerns pay their experienced salesmen a straight commission, based on the dollar amount of sales made; others pay a fixed salary; and still others—the majority—use a combination salary-plus-commission plan. The amount earned through commissions varies according to the salesman's efforts and ability, the percentage commission, location of his sales territory, nature of the products sold, types of customers, and other factors. The



salary of many experienced salesmen was between \$16,000 and \$22,000 annually. Most earned considerably more because of bonuses and commissions.

Some manufacturers' salesmen have large territories and do considerable traveling. Others usually work in the neighborhood of their "home base." For example, a salesman of heavy industrial equipment may be assigned a territory covering several States and often may be away from home for days or weeks at a time. On the other hand, a salesman of food products may work in a small area which is within commuting distance of his home.

When away from home on business trips, salesmen are usually reimbursed for such expenses as transportation costs, hotel bills, meals, tips, telephone calls, and stenographic services. Some companies either provide a car or pay an allowance to salesmen who use their own cars.

Salesmen often work irregular hours. They make calls at the time most convenient to their customers, and often have to travel at night or on weekends to meet their schedules. Frequently, they spend evening hours writing reports and planning itineraries. However, some salesmen, because of the nature of their positions, can plan their work schedules so they can take time off when they want it. Most salesmen who are not paid on a straight-commission basis receive 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

For more information on the occupation of manufacturers' salesmen, write to:

Sales and Marketing Executives—International, Youth Education Department,  
630 Third Ave., New York, N.Y.  
10017.

The Council on Opportunities in Selling, Inc.,  
630 Third Ave., New York, N.Y.  
10017.

## INSURANCE AGENTS AND BROKERS

(D.O.T. 250.258)

### Nature of Work

Insurance agents and brokers sell policies or contracts which protect individuals and businesses against future losses and financial pressures. They also provide their customers with many services related to the in-

surance they sell. They may, for example, assist in planning the financial protection which best meets the special needs of a customer's family; advise about the types of insurance best suited for the protection of an automobile, home, business establishment, or other property; or help a policyholder in obtaining settlement of an insurance claim.

The many kinds of insurance available are of two main types—life insurance, and property and liability (or casualty) insurance. Agents and brokers usually specialize in selling one of these two types of insurance. Policies sold by life insurance agents provide payment to survivors in the event of the policyholder's death;



Insurance agents go to the client.

they may also provide annuities, funds for the education of children when they reach college age, and other benefits which the policyholder has arranged for, anticipating he would need these funds at some future time. Property and liability insurance policies protect policyholders from financial losses which they might otherwise incur because of automobile accidents, fire and theft, or other hazards. Agents selling either of these two types of insurance may also sell health insurance.

An insurance agent may be either an insurance company employee or an independent businessman who is under contract to act as the authorized representative of one insurance company or more. A broker occupies a somewhat different position; he is not under contract to any particular company, but places the policies he sells with whatever insurance company he feels best meets his clients' needs. In other respects, agents and brokers do much the same kind of work.

Agents and brokers spend most of their time discussing different types of insurance policies with prospective customers. Some time must be spent in office work—planning insurance programs that are specially tailored to prospects' needs, preparing reports, maintaining records, and drawing up lists of prospective customers. An agent's or a broker's success depends on his ability to make sales. Therefore, he must have the initiative to locate new prospects, and he must have a thorough knowledge of insurance fundamentals so that he will be able to evaluate his client's insurance needs and explain policy terms clearly. Equally important is the ability to establish friendly relations and maintain the confidence of his clients, many of whom seek advice as well as information about their insurance requirements.

(See chapter on Occupations in the Insurance Business for additional information about life insurance and property and liability insurance companies.)

### Where Employed

More than 400,000 agents and brokers sold insurance in 1967. About half of them were engaged primarily in selling life insurance, and the remainder sold property and casualty insurance. Nine out of every ten agents and brokers were men. Many additional agents—both men and women—sold insurance on a part-time basis.

Insurance agents and brokers are employed in all parts of the country, but the greatest number work in large cities.

### Training, Other Qualifications, and Advancement

Although employers seldom specify age limits or formal educational requirements, practically all agents hired in recent years have been at least 21 years of age and more than half of them have had some college training. Many were college graduates. College training, although not essential, may be an aid to the agent in grasping insurance fundamentals and in establishing good personal relationships with prospective clients. Courses in accounting, economics, finance, and business law, as well as courses in insurance subjects, are considered helpful. A liberal arts curriculum may be equally desirable in preparing the prospective agent. Sales ability is also important. Some skill in salesmanship can be acquired through experience and from a study of the principles and techniques of selling, but much comes from natural aptitude—a capacity for meeting and talking easily with strangers, together with a cheerful personality, self-confidence, and enthusiasm.

All insurance agents and most brokers must obtain licenses in the States where they plan to sell insurance. In most States, licenses are issued only to applicants who pass written examinations covering insurance fundamentals and the State insurance laws.

Before they start selling, new agents usually receive training at insurance company home offices or at the agencies and brokerage firms where they will be working. Some insurance companies sponsor classes in sales problems and insurance principles. This instruction may be given over a period of several weeks or a few months. In other cases, training takes the form of working on the job under the direct supervision of experienced sales personnel.

Agents and brokers have opportunities to broaden their knowledge of the insurance business by enrolling in intermediate and advanced courses available at many colleges and universities and by attending institutes, conferences, and seminars sponsored by insurance organizations. As an agent or broker acquires experience and broadens his knowledge of the insurance business, he can, by passing a series of examinations given by the American Society of Chartered Life Underwriters, qualify for the designation Chartered Life Underwriter (CLU). In much the same way, a property and liability agent, by passing an examination given by the American Institute for Property and Liability Underwriters, Inc., will qualify for the Chartered Property Casualty Underwriter (CPCU) designation. The CLU and CPCU designations are recognized marks of attainment in their respective fields.

Insurance agents who demonstrate sales ability and leadership qualities may be promoted to positions as sales or agency managers in district or sales offices or to other managerial positions in home offices of insurance companies. A few may advance to top positions as agency superintendents or company vice-presidents or presidents. Many agents who have built up a good clientele prefer to remain in sales work, however. Some, particularly in the property and liability field, eventually establish their own independent agencies or brokerage firms.

### Employment Outlook

Nearly 15,000 job openings for insurance agents and brokers are expected to arise each year during the rest of the 1960's and through the 1970's. Some will be new jobs created as employment expands, and others will be to replace agents and brokers who retire or stop working for other reasons. Because the rate of turnover is high among beginners in this occupation, many workers will also be needed to replace insurance agents who leave to enter other types of employment.

The number of insurance agents and brokers is expected to continue to increase slowly. As population and incomes rise and life expectancy increases, more families will depend on life insurance and on policies which provide protection in the form of retirement income, medical care, and funds for a college education for their children. Expansion in industrial plant and equipment and increases in major consumer purchases such as a home or automobile, will contribute to increased sales of property and liability insurance. Despite the expected increase in the number of policies issued, however, insurance selling will remain a keenly competitive field.

### Earnings and Working Conditions

Beginners in this occupation are often guaranteed moderate salaries or advances on commissions while they are learning the business and building up a clientele. Thereafter, most agents are paid on a commission basis. The size of the commission varies, depending on the type and amount of insurance sold and on whether the transaction involves a new policy or the renewal of a policy already in force. After a few years, an agent's commissions on new policies sold and on renewals may range from \$5,000 to \$15,000 annually. A number of established and highly successful agents and brokers earn \$30,000 or more.

Agents and brokers generally pay their own automobile and traveling expenses. In addition, those who own and operate independent businesses must pay office rent, clerical salaries, and other operating expenses out of their earnings.

Although insurance agents are usually free to arrange their own hours of work, they often schedule appointments during evenings and weekends for the convenience of clients. Some agents spend more than the customary 40 hours a week on the job.

### Where To Go for More Information

General information on the occupation of insurance agent and broker may be obtained from the home office of many life insurance and property and liability insurance companies. Information on State licensing requirements may be obtained from the department of insurance at any State capital.

Additional information about life insurance agents may be obtained from:

Institute of Life Insurance,  
277 Park Ave., New York, N.Y.  
10017.

Life Insurance Agency Management  
Association,  
170 Sigourney St., Hartford, Conn.  
06105.

The National Association of Life  
Underwriters,  
1922 F St. NW., Washington, D.C.  
20006.

Information about property and liability agents and brokers can be obtained from:

Insurance Information Institute,  
110 William St., New York, N.Y.  
10038.

National Association of Insurance  
Agents, Inc.,  
96 Fulton St., New York, N.Y.  
10038.

Insurance Institute of America, Inc.,  
270 Bryn Mawr Ave., Bryn Mawr,  
Pa. 19010.

### REAL ESTATE SALESMEN AND BROKERS

(D.O.T. 250.358)

#### Nature of Work

Real estate salesmen and brokers are at the center of most property transactions. They represent property owners who want to sell and find potential buyers for residential and commercial properties. Salesmen and brokers may also be called *real estate agents*, or if they are members of the National Association of Real Estate Boards, "*Realtors*."

Salesmen are employed by brokers to show and sell real estate; some handle rental properties. Brokers are independent businessmen who not only sell real estate but sometimes rent and manage properties, make appraisals, arrange for loans to finance purchases, and develop new building projects. In addition, brokers manage their offices, advertise properties, and do other things necessary to operate their businesses. Some of those who possess the necessary qualifications combine other work, such as selling insurance or practicing law, with their real estate businesses.

Most real estate salesmen and brokers sell residential property, sometimes specializing in homes within a certain price range or in a particular area of a city. A few, usually those in large real estate firms, specialize in commercial, industrial, or other types of real estate. Each speciality requires knowledge of and experience in the particular type of property. For example, salesmen who specialize in commercial sales or leasing must understand leasing practices, business trends, and location needs. Salesmen selling or leasing industrial properties must be able to supply information on transportation, utilities, and labor supply. Salesmen who handle farm properties must have considerable knowledge of soil types, water supply, drainage, and transportation facilities.

An important duty of salesmen is obtaining "listings" (getting owners to place properties for sale with the firm). Salesmen spend much time on the telephone, seeking such "listings" and answering inquiries about properties. They obtain leads for listings through advertising and personal contact.

Because a real estate purchase is a large investment, most people buy only after careful investigation and deliberation. A real estate salesman must therefore spend much time away from his office showing and discussing properties with prospective buyers. When a number of houses are for sale in a new development, the salesman may operate from a model home. He explains special features which will meet particular needs of the prospective buyer (or renter) such as location of schools, churches, parks, stores; type of neighbors; community facilities; mortgage possibilities; water supply; and rubbish disposal. With a businessman, he may discuss the income potential of the property and answer questions about zoning, transportation, and community facilities. He must also be familiar with tax rates and insurance needs. It is important that he try to meet the buyer's needs and preferences and, at the same time, follow the seller's instructions. When bargaining on price is necessary, the salesman or broker must be a skillful negotiator who considers both the buyer's and the seller's interests. 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 details of the transaction are agreed upon and the new owner takes possession of the property.

Real estate salesmen and brokers usually spend some of their time checking listings of properties for sale or rent and making telephone calls to prospective clients. They may also answer telephone inquiries about properties, arrange appointments to show real estate, and keep records of properties listed, shown, sold, or rented.

### Where Employed

The number of people whose main occupation was selling real estate in early 1967 is estimated at more than 230,000, of whom more than two-thirds were men. A very large number of people also sold real estate occasionally. The total number of men and women licensed to sell was about 800,000 in 1965, according to the National Association of Real Estate License Law Officials.

Most real estate salesmen work for small business establishments; a few, in metropolitan centers, work for firms having large sales staffs. Brokers are generally self-employed. Salesmen and brokers are found in every part of the country, but are concentrated in large urban areas and in smaller rapidly growing communities.

### Training, Other Qualifications, and Advancement

A license is required for work as a real estate salesman or broker in every State and in the District of Columbia. All States require prospective agents to pass written examinations which generally include questions on the fundamentals of real estate transactions and on laws affecting the sale of real estate. The examination is more comprehensive for brokers than for salesmen. In more than three-fifths of the States, candidates for the broker's license must also have a specified amount of experience as a real estate salesman or the equivalent in related experience or education (generally from 1 to 3 years). In some States, college credits in real estate courses may be substituted for experience. State licenses usually can be renewed annually without reexamination.

Although a specified amount of education is seldom required, employers prefer to hire persons who have at least a high school education. A broad academic program in high school including such courses as English, mathematics, salesmanship, architectural drawing, business law,

economics, and public speaking is considered helpful for those planning a career in real estate. Most real estate agents have some college training and many are college graduates. College courses in real estate subjects as well as psychology, economics, finance, and business administration are assets to persons seeking to enter real estate sales.

Characteristics important for success in selling real estate include a pleasing personality, neat appearance, enthusiasm for the job, maturity, integrity, and tact and patience in dealing with prospective customers. Agents should also have a good memory for names and faces as well as for prices and other facts relative to the business.

Young men and women interested in beginning jobs as real estate salesmen often apply to brokers in their own communities, where they can use to advantage their knowledge of local neighborhoods. The beginner usually works under the direction of an experienced salesman or broker while he learns the practical aspects of his job.

Training opportunities are available for both beginners and experienced agents. Many firms offer formal training programs for salesmen. More than 200 colleges and universities offer one or more courses in real estate and, at many, a student can earn the bachelor's degree with a major in real estate; some offer advanced degrees. Many local real estate boards which are members of the National Association of Real Estate Boards (NAREB) sponsor courses in subjects such as real estate fundamentals; principles, and practices; real estate law; and real estate financing. Advanced courses in appraisal, mortgage financing, and property development and management are also available through local real estate boards and NAREB affiliates such as the American Institute of Real Estate Appraisers and the Institute of Real Estate Management.

Salesmen with experience and training can advance in many ways. In a larger real estate firm, a sales-

man may become a sales manager. A few, especially in large real estate firms, may be promoted to general manager. Those who become licensed brokers may open their own offices. Training and experience in estimating the value of property can lead to work as a real estate appraiser. Persons familiar with the problems of operating and maintaining rental properties may specialize in property management. Those who gain wide general experience in real estate and a thorough knowledge of business conditions and property values in their localities may enter the field of mortgage financing or real estate counseling.

### Employment Outlook

Several thousand openings for real estate salesmen are expected to arise each year during the rest of the 1960's and through the 1970's. Many will be new positions created by the need for more salesmen to serve a growing population. The majority, however, will be openings resulting from turnover. Because the average age of real estate salesmen and brokers is considerably higher than that of workers in most occupations, death and retirement losses are high. In addition, a relatively large number of agents—many of them beginners—transfer to other types of work.

Most of the full-time jobs that become available will be for men. Women will find increasing opportunities in real estate, however, because of their familiarity with home features of special interest to housewives, who share decisions on home purchases. Many openings are likely to be filled by mature workers, including persons who transfer from other kinds of sales work. Although part-time workers will continue to find opportunities for employment, the proportion employed on this basis may decline, as State licensing requirements change and more specialized knowledge is necessary for the agent who handles real estate transactions.

Employment of real estate salesmen and brokers is expected to rise moderately, particularly during the early 1970's when the many young people born shortly after World War II will be purchasing or renting their own homes. Other factors contributing to a growing need for agents are: The expected expansion in residential and commercial construction resulting from the increase in population and economic activity, migration to metropolitan areas, and urban renewal. Although this field is likely to remain highly competitive, persons with an aptitude for selling real estate will therefore find that it offers many career opportunities in the future.

### Earnings and Working Conditions

Commissions on sales are the usual source of earnings for most real estate salesmen and brokers. A few are paid on a straight salary basis, although this is the exception rather than the rule. The usual commission on the sale of a moderately priced home was 5 percent in early 1967, although 6 percent was being paid in a growing number of localities. Thus, the sale of a house for \$20,000 would bring a commission of \$1,000 to \$1,200. Somewhat higher commissions might be paid on the sale of farm and commercial properties and unimproved land.

Commissions on the sale of properties may be shared by several employees of a real estate firm. Often, when a sale is made, a small proportion of the commission is paid to the salesman who obtained the listing of the property. The rest of the commission is either retained by the broker, if he made the sale, or, if the property was sold by an agent in his employ, it is shared by the broker and the agent. An agent's share of the commissions on the sales he makes varies greatly from one real estate firm to another; frequently it is about half of the commission.

Many full-time real estate agents earn between \$5,000 and \$10,000 a year, according to the limited data

available. Beginners usually earn less. At the other extreme, there are many experienced salesmen whose yearly incomes are \$15,000 or more.

Income usually increases as an agent gains experience, but earnings are also affected by individual ability, type of property sold, geographic location, economic conditions, and other factors. Those salesmen who are active in community organizations and on 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, and then several sales may be made close together. For this reason, some brokerage firms pay their salesmen a "draw" against future commissions; this is not the usual practice with beginners, however, and most new salesmen should have enough money to support themselves until their income from commissions becomes large enough to meet their living expenses.

Salesmen are provided with office space by the brokers for whom they work. They are expected to furnish their own automobiles. Although salesmen and brokers have much independence in planning their working schedules, it is often necessary for them to work in the evening hours and during weekends because of the nature of the work and the need to meet the convenience of customers. Some salesmen, especially those who work for large firms, are provided with group life, health, and accident insurance.

### 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. Many States can furnish manuals which help applicants prepare for the required written examinations.

Additional information on opportunities in the real estate field, and a list of colleges and universities offering real estate courses may be obtained by writing to:

Department of Education, National Association of Real Estate Boards, 155 East Superior St., Chicago, Ill. 60611.

## SECURITIES SALESMEN

(D.O.T. 251.258)

### Nature of Work

Almost every time an investor buys or sells stocks, bonds, or shares in mutual funds, it is the securities salesman who puts the "market machinery" into operation. A salesman's services are usually required not only by the individual with a few hundred dollars to invest, but also by the large institution with millions. Securities salesmen are often called *customers' brokers, registered representatives, or account executives.*

In executing a buy or sell order, a securities salesman usually relays the order through his firm's order room to the floor of a securities exchange or, if the security is traded in the over-the-counter market, he sends it to his firm's trading department. After the transaction has been completed, the salesman notifies the customer to that effect. He also provides many kinds of related services for his customers. To an inexperienced investor, for example, he may explain the meaning of stock market terms and trading practices. For customers with a variety of holdings, the salesman may offer suggestions about the purchase or sale of a particular security, when circumstances indicate this is advisable. Or, in order to meet a customer's investment objectives—whether they are long-term investments designed to provide a steady income over the years or short-term investment which appear likely to rise in price quickly—a salesman may furnish information about their advantages and disadvantages. Sales-

men are often expected to furnish for their customers the latest stock and bond quotations as well as information regarding the activities and financial positions of corporations.

Some salesmen perform these services for all types of customers; others deal either with individual investors or institutional investors. Many specialize in certain kinds of securities; for example, because of the nature of the firm where he works, a salesman may handle only transactions in municipal bonds or only shares in mutual funds. Salesmen employed by investment bankers and by other firms which underwrite "new issues," such as the securities issued by corporations needing funds for plant expansion, may take part in the initial sale of these new securities.

Building a clientele is very important to the securities salesman's success. Most salesmen new to the occupation, therefore, spend much of their time contacting potential investors and individuals who once did business with their firm, or seeking new customers in other ways. On the other hand, an experienced salesman—although always on the alert for new clients—may spend most of his time servicing the accounts of his established customers.

### Where Employed

In early 1967, more than 110,000 men and women spent all or a part of their time selling securities. The great majority were men. Approximately three-fifths were full-time employees of securities firms, and most of these were salesmen; the rest—partners, branch office managers, security analysts, and others—spent only part of their time in sales activities. Other people who sold securities—roughly 45,000 in all—were men and women regularly employed in jobs outside the securities business; most of these persons sold shares in mutual funds in the evenings and on weekends.

Securities salesmen are employed by hundreds of brokerage firms, investment bankers, and mutual fund

firms in all parts of the country. Many of these firms are very small. Most salesmen, however, work for a relatively small number of large firms, which, in addition to their main offices located in big cities (especially in New York City), operate more than 5,000 branch offices.

### Training, Other Qualifications, and Advancement

Almost all States require securities salesmen to be licensed. State licensing requirements vary: Personal bonds may be required, for example, or it may be necessary for applicants to pass written examinations.

In addition, practically every salesman must be registered as a representative of his firm in accordance with the regulations of the securities exchange or exchanges through which it does business or the National Association of Securities Dealers, Inc. (NASD), or both. Before beginners with no previous experience in selling securities can qualify as registered representatives, they must pass written examinations, prepared by the exchanges and/or the NASD, which test their knowledge of the securities business. Character investigations are also required.

To assist their salesmen in meeting the requirements for registration, most employers provide training for beginners. In many firms, including all those which are members of the New York Stock Exchange, the training period lasts for at least 6 months. In large firms, training programs are sometimes quite elaborate: Trainees may receive classroom instruction in subjects such as security analysis and effective speaking, take courses offered by schools of business and other institutions and associations, and undergo a period of on-the-job training. Other training programs, particularly in small firms, may be relatively informal and brief—the trainee may read assigned materials and observe other salesmen transact business.

Because a securities salesman must be well informed about economic

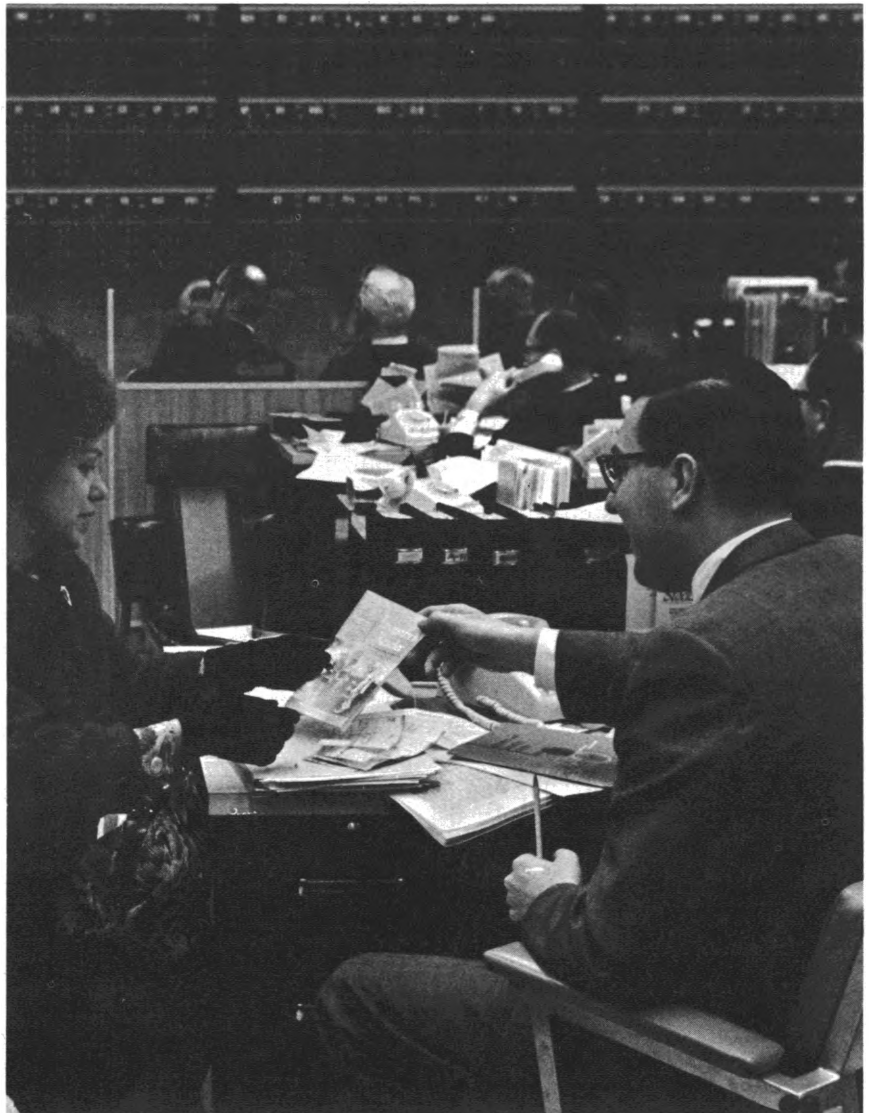
conditions and trends, a college education is becoming increasingly important for beginners who seek to enter this field. Although employers seldom require specialized training, a degree in business administration or economics, or a broad background in liberal arts subjects is regarded as especially good preparation for the work. Courses in finance and other subjects related to the securities business, available at colleges and universities throughout the country, are also helpful.

Many employers consider personality traits as important as academic training in specialized fields. Employers seek people who are well groomed, who possess the ability to deal with people, and who are ambitious and have a sense of responsibility. Because maturity is also important, many employers feel that it is desirable for prospective salesmen to have had a few years of experience in other kinds of jobs. Before being hired, applicants are sometimes given tests to determine their aptitude for this kind of sales work.

The principal form of advancement for securities salesmen is an increase in the number and the size of the accounts they handle—and therefore their earnings. Thus, beginning salesmen, who usually start by servicing the accounts of individual investors, may in time handle very large accounts such as those of institutional investors. Some experienced salesmen may advance to positions as branch office managers, supervising the work of other salesmen while executing buy and sell orders for their own customers, and a few may eventually become partners in their firms or do other administrative work.

### Employment Outlook

Employment opportunities for securities salesmen are expected to be very good during the rest of the 1960's and through the 1970's. Approximately 10,000 openings are likely to arise each year. Some will be new positions created to serve the



Securities salesman explains investment transaction to customer.

growing number of individuals and institutions investing money in securities of all kinds. Most positions, however, will be vacancies that occur as salesmen retire or leave the occupation for other reasons. Turnover tends to be high, especially among beginners.

The number of securities salesmen has more than doubled during recent years; and, although the rate of increase may be slowed somewhat in future years, employment is expected to continue to rise very rapidly. The number of individual investors and the funds they have to invest will con-

tinue to increase, not only because of economic growth and rising personal incomes, but because of a number of other factors. These include, for example, interest stimulated by the activities of investment clubs and associations, plans enabling small investors to make monthly payments toward the purchase of securities, and the increasing need for parents to set aside funds for their children's education and their own retirement. Institutional investors can also be expected to have more funds for investment as more people purchase insurance; participate in pension plans;

contribute to the endowment funds of colleges, universities and to other nonprofit institutions; and deposit their savings in banks. Many more securities salesmen will also be needed to sell new securities issued by expanding corporations and by State and local governments which are financing the construction of new roads and other public improvements.

### Earnings and Working Conditions

Trainees are usually paid a salary until such time as they are able to meet licensing and registration requirements. After registration, a few firms continue to pay a salary until the new salesman's commissions increase to a minimum amount. The salaries paid during the training period may be modest or may, particularly in large firms, range from \$400 to \$500 or more a month, depending on the locality, the individual's educational background, and other factors.

Once the salesman has completed his training, earnings are usually in the form of commissions from the sale and purchase of securities by customers. The size of the commission depends partly on the policies of the firm where the salesman works and partly on the type of security bought or sold and whether it was traded on a stock exchange or in the over-the-counter market. Commission earnings may fluctuate a great

deal because of extremes in market activity. When there is much buying and selling of securities, earnings are likely to be high; when there is a severe slump in market activity the opposite is likely to be true. To provide their salesmen with a steady income, most firms pay a "draw against commission"—that is, a minimum salary based on the commissions which salesmen can be expected to earn—plus any commissions from additional sales. A few firms pay salesmen only a salary and bonuses which are usually determined by company business.

According to the limited data available, securities salesmen working full time generally earned between \$8,000 and \$17,000 a year in 1967. Many successful salesmen have incomes in excess of \$25,000 a year, however. Salesmen paid on a commission basis, sometimes also receive annual bonuses from their firms when business is good.

A securities salesman works in an office which is usually the scene of a great deal of activity. In large offices, there are likely to be rows of salesmen sitting at desks in front of "quote boards" and wall screens, which continually flash information on securities transactions and prices. Seats are usually provided in most offices so that customers and others may watch the latest market developments.

Although securities salesmen are not usually required to observe a

fixed schedule of hours of work, many work approximately the same hours as others in the business community. Some salesmen must adjust their time to accommodate those customers who can meet with them only outside business hours—for example, at lunch time, or at home in the evenings and on weekends.

### Where To Go for More Information

Further information about the work of the securities salesman in firms which are members of the New York Stock Exchange and about the nature of the securities business is available from:

New York Stock Exchange,  
11 Wall St., New York, N.Y. 10005.

Information about the investment banking business and sales positions with investment bankers may be obtained from:

Investment Bankers Association of  
America,  
425 13th St. NW., Washington, D.C.  
20004.

General information about the over-the-counter market and requirements for becoming a registered representative of a member firm of the NASD is available from:

National Association of Securities  
Dealers, Inc.,  
1707 H St. NW., Washington, D.C.  
20006.

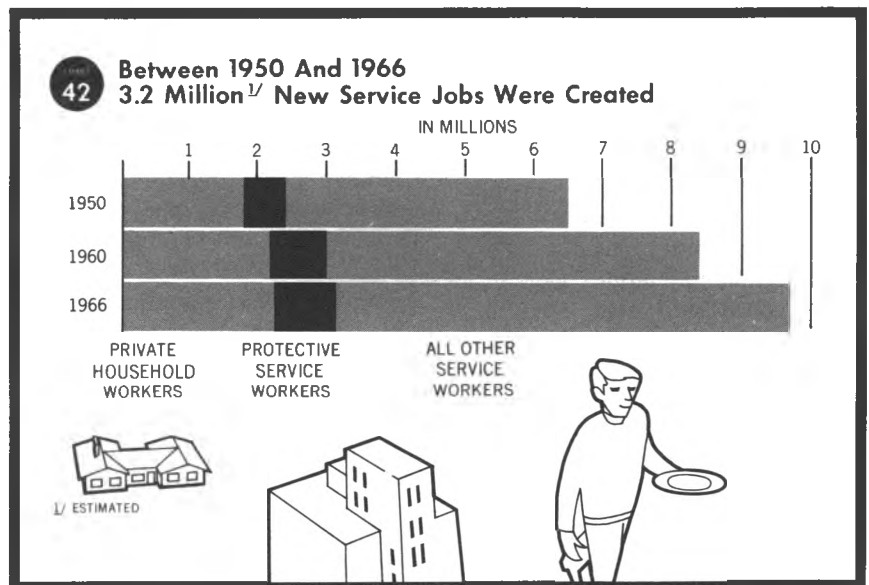


## SERVICE OCCUPATIONS

The service occupations are made up of workers who police the streets, serve food, put out fires, help to clean our homes and buildings, and, in numerous other ways, provide services to the American people. The nearly 9.7 million service workers who were employed in 1966 included a wide range of diverse occupations such as babysitters, policemen, firemen, cleaning women, golf caddies, theatre ushers, barbers, and laundresses. The major groups of service workers are discussed below:

*Occupations related to food preparation and service.* About 2.5 million people, or approximately three-tenths of all service workers, are employed in this group which includes occupations such as cooks and chefs, kitchen workers, waiters and waitresses, counter and fountain workers, and bartenders. These workers are employed in hotels, restaurants, and other institutions, such as hospitals, schools, and plant cafeterias.

*Private household workers.* Nearly 2.2 million people are employed as private household workers. Altogether they make up the second largest



est group of service workers; they constitute almost one-fourth of all service worker employment. Private household workers perform tasks that are familiar to all homemakers. They prepare and serve meals, make beds, do cleaning and laundering, take care of children, and perform other household duties as well. (This chapter includes a detailed statement covering

private household workers.)

*Building cleaning and servicing occupations.* The nearly 2 million persons employed to clean and provide other services in hotels and other buildings make up the third largest group of service workers. This group includes workers in occupations such as janitors, charwomen, chambermaids, porters, and elevator operators.

*Protective service workers*, another large group of service workers, are needed to help safeguard lives and property. More than 900,000 workers, or one-tenth of all service workers, are employed in protective service occupations. The majority of these workers are policemen, guards, or firemen. Policemen and detectives together account for two-fifths of the total number of protective service workers. Most policemen and detectives are government employees, but some work for hotels, stores, and other businesses. Guards and watchmen, another large group of protective service workers, are employed chiefly by private companies to protect their property and enforce company rules and regulations. Some guards and watchmen are employed in jails, prisons, and other government establishments. Firemen, also a significant group of protective service workers, work mainly for city governments. The remaining protective service workers are sheriffs and bailiffs, crossing watchmen and bridge tenders, and marshals and constables. This chapter includes separate statements for FBI agents, policemen and policewomen (local government), State police officers, and firemen.

The remaining service workers—those concerned with providing health care, grooming and personal services, and people in occupations related to entertainment and leisure time activities—account for 2 million workers. About 1 million are employed in health service occupations, which include workers such as hospital attendants and nurse aides. Service occupations concerned with grooming and personal services such as barbers and cosmetologists provide employment for another 700,000 workers. About 100,000 workers work in occupations related to entertainment. This group includes occupations such as ski instructors, ushers and check room attendants. All other service workers, about 300,000, are in such diverse occupations as fashion model, airline stewardess, and travel guide.

Some of the occupations mentioned briefly in this introduction are described in greater detail later in this chapter. They are cook and chef, waiter and waitress, hospital attendant, barber, and cosmetologist. Other personal service occupations including the airline stewardess, hotel bellman, and hotel housekeeper and assistant are discussed elsewhere in the *Handbook*.

### **Training, Other Qualifications, and Advancement**

Training and skill requirements differ greatly among the various service occupations. FBI agents, for example, must have a college degree. Barbers, beauty operators, and some other workers need specialized vocational training. For still other occupations—general maid, waitress, elevator operator, and hotel bellman, for example—formal educational requirements for entry usually are not specified. A high school diploma is always an advantage, however. The Federal Government also sponsors training for many service occupations under provisions of the Manpower Development and Training Act of 1962.

For many service occupations, special personality traits and abilities may be as important as formal schooling. Thus, physical strength and endurance are a necessity for work as a porter, life guard, or window cleaner; and a pleasing manner and appearance are especially important for the theater usher, elevator operator, checkroom girl, and fashion model. Other service workers, including store and hotel detectives and travel guides, should possess good judgment and ingenuity and be skillful in dealing with people.

Some service workers eventually go into business for themselves—as caterers or restaurant operators, for example, or proprietors of barber or beauty shops. Others, such as elevator operators and ushers, may work up to supervisory positions. Advancement from service occupations that require

little specialized training or skill may be difficult, however, particularly for young people without a good basic education and some knowledge of the business in which they are employed.

### **Employment Trends and Outlook**

The number of workers in service occupations has been increasing much faster than the labor force as a whole for many years. Since 1950, overall employment has increased by more than one-half. Private household workers increased much more slowly—by about one-fifth in the 17-year period since 1950, and protective service workers increased by almost one-half. The remaining occupations together increased by about two-thirds since 1950. (See chart 42.)

Employment in service occupations is expected to continue to increase very rapidly in the years ahead as income levels rise and leisure time increases. By 1980, as many as 4 million more workers may be providing the services that add to people's comfort and enjoyment and protect life and property. As total employment rises, however, different occupations within the service group are likely to be affected quite differently—some growing very rapidly, others only moderately, and a few decreasing in size.

Most of the employment increase in future years is expected to be among policemen and other protective service workers; attendants in hospitals and in businesses rendering professional and personal services; beauty operators; and cooks, waiters, and others who prepare and serve meals outside private homes. Practically all of these large occupations are expected to grow rapidly. Some of the factors responsible for their growth are the added medical care and other health service related to the increase in population, and especially in the number of older people; the greater need to protect life and property as urbanization continues and cities become more crowded; and the

more frequent use of restaurants, beauty parlors, and other services by families and individuals as income levels rise and as an increasing number of housewives take jobs outside the home.

Only a moderate increase is anticipated in the numbers of workers employed full time in private homes. New products and equipment will continue to limit the number of domestic workers needed. Timesavers such as frozen foods, drip dry textiles, automatic washer-dryers, and garbage disposal units tend to restrict demand for household workers. Some other service occupations also affected by new products and equipment, such as elevator operator, porter, bowling alley pinboy, and bootblack, are expected to show employment declines. However, the employment decline in these occupations is expected to be more than offset by other service occupations that expand.

Service workers are employed in every city and village in the Nation. Hospital attendants, maids, bellmen and other hotel service employees, and ushers and attendants at theaters and other places of amusement are found chiefly in the larger towns and cities, however.

**PRIVATE HOUSEHOLD WORKERS**

(D.O.T. 301.887; 302.887; 303.138 and .878; 304.887; 305.381; 306.878; 307.878; and 309.138 through .999)

**Nature of Work**

Private household work is one of the largest areas of work for women, who accounted for nearly all of the almost 2.3 million household workers employed in early 1967. Although all household workers are engaged in providing help in the home, many different job titles are used.

The great majority of women household employees work as maids of various kinds. The *general maid* (or *day worker*, if employed by the



hour or day), as instructed by her employer, performs a variety of duties, such as cleaning household furnishings, floors, and lavatories; changing and making beds; attending children at play; washing dishes; buying, cooking, and serving food; and washing and ironing clothes. The *mother's helper*, under her employer's supervision, performs similar duties while learning on-the-job. More specialized duties are performed by other kinds of maids. The *personal maid* performs personal services for a woman employer, such as keeping her employer's clothes in good condition by mending, cleaning, washing, and pressing garments, or by having these services performed; cleaning and keeping private quarters tidy; and helping her employer dress. The *nursemaid* cares for the children, giving baths, supervising play activities and outings, washing and ironing clothes, and preparing meals. When caring for infants, she is called an *infant's nurse* and her duties include sterilizing bottles and other feeding equipment, preparing formulas, and feeding the child at scheduled periods during the day and night. *Babysitters* may perform some or all of the duties of a nursemaid or infant's nurse, but on a daily or an hourly basis.

Housekeepers usually have more responsibility and are under less supervision than maids. The *home housekeeper* manages a household where there is a large staff of other household employees. She directs their activities, orders food and cleaning supplies, keeps an expenditure record, and may hire and discharge employees. The *working housekeeper*, or her rural counterpart, the *farm housekeeper*, often is the only employee in homes where the housewife is absent or is unable to do her own housework. Their household duties are similar to those of the general maid in addition to a housekeeper's responsibilities. The *farm housekeeper* also assists in light farm chores, such as feeding chickens, and picking fruits and vegetables for the table.

The *cook* and *laundress* usually take care of only one aspect of household work, as their titles suggest. The laundress washes and irons household laundry, seldom doing other housework. The cook prepares meals, planning her own menus or following instructions. She prepares vegetables and meats for cooking, or supervises a *cook's helper* who performs these tasks and other work requiring little skill. The cook may also serve meals and perform special cooking duties such as making preserves and fancy pastries.

A *companion* lives with a convalescent or a person who is alone, acting as an aid and friend, and is generally one who has the same social background as the employer. A companion attends to the employer's personal needs, looks after social or business affairs, and keeps the employer amused by reading, conversing, and playing games. A *governess* has charge of children in a home, usually supervising their recreation, diet, health, deportment, and education, according to parents' instructions. Among her duties are teaching music and languages, arranging outings, and, sometimes, taking disciplinary measures.

Although women predominate in household work, some occupations are typically performed by men. The

*man-of-all-work*, sometimes called the *handyman* or *odd-job man*, performs a variety of duties to keep a private home clean and in good condition, such as dusting furniture, washing windows, waxing and polishing floors, tending the furnace, repairing screens, painting fences, and caring for the yard. When employed the year-round he may be called the *caretaker*, and when concerned only with taking care of the house, a *houseman*. The *valet* performs personal services for a male employer, such as brushing, cleaning, ironing, mending, and laying out clothing; mixing and serving drinks; and running errands. The *butler* may supervise household workers, assigning and coordinating their work; receive and announce guests; answer the telephone; handle the serving of food and drinks; and he may also act as a valet and perform other services. In households not large enough to require the services of both a butler and a chauffeur, or butler and a houseman, a combination of the duties of both occupations may be performed by one person who is referred to as *butler-chauffeur*, or *butler-houseman*.

### Where Employed

Nearly half of all household workers in 1960 worked in the South; most of the rest were about evenly divided between the North Central States and the Northeastern States, and only about 10 percent were in the West. About three-fourths of all household workers were in city areas.

Almost all household workers spend most of their working time in their employer's residence; laundresses, the exception, may perform their work in their own or their employer's home. Few household workers "live in," that is, live in their employer's home.

### Training, Other Qualifications, and Advancement

For most household workers, there are no formal educational require-

ments. The ability to cook, sew, wash and iron, clean house, and care for children is generally acquired by girls while helping with the housework in their own homes. This ability may be acquired by working for about a year as an assistant to an experienced household worker or housewife (as a mother's helper). Most employers prefer workers who can operate household equipment such as vacuum cleaners, floor waxers, dishwashers, and electric mixers. Home economics courses offered in high schools, vocational schools, and junior colleges, as well as training courses sponsored by Federal agencies, State employment service offices, and local welfare departments are all helpful in developing home service skills beyond the level ordinarily reached in the home.

With the knowledge acquired at home, or as a mother's helper, a woman can take a job as a general household worker or nursemaid. With this experience or with the skill acquired in a special training program, a woman can progress to a personal maid, infant's nurse, cook, or housekeeper.

For the positions of governess and companion, actual work experience is less important than educational and cultural background. A companion should be similar to the employer in age, interests, and background. Practical nursing experience is helpful if the employer is feeble or an invalid. A broad educational background in the arts is useful to a governess. Special skills in music, in a foreign language, and in teaching young children are helpful.

Because of the close contact between household workers and members of the families for which they work, employers look for agreeable and trustworthy workers who are neat, clean, and in good health. Some employers require their household workers, particularly cooks and infant's nurses, to have a health certificate; they may arrange and pay for the necessary physical examination.

Advancement other than a wage increase is generally not available

within households with only one or two workers. To get a better job, a domestic worker usually must change to a home where a job requiring greater skill is available, and these opportunities are limited in number.

### Employment Outlook

Employment opportunities for private household workers are expected to be excellent during the rest of the 1960's and through the 1970's. In addition to new jobs that will be created as the economy expands, thousands of job openings will occur each year as private household workers die, retire, or enter other types of employment. Retirements and deaths alone will result in around 150,000 openings annually. Additional openings will arise as workers transfer to other kinds of work.

Employment of private household workers is expected to increase moderately as family incomes, and the number of wives and mothers working outside the home continues to rise. Well-trained, competent household workers (both to "live out" and to "live in") are expected to be in great demand.

### Earnings and Working Conditions

Wages of household workers vary according to such factors as the size of the employer's income, kind of work performed, and local standards of pay. Wages tend to be higher in large cities, especially in the northern part of the country. Workers who "live in" generally are paid the same wage rates as those who "live out," and get free room and board. Workers who "live out" usually receive a free meal plus the cost of their transportation. According to limited data available, most private household workers earn between \$0.90 and \$1.25 an hour.

Even though modern washing and cleaning equipment and materials have helped considerably, housework involves some hard labor at times,

especially for dayworkers, who are usually given the heavier tasks in the home. "Live-ins" in homes with no other household workers are likely to be alone most of the time; this situation, plus the length and irregularity of working hours, isolates the worker from family and friends.

Dayworkers generally acquire customers for whom they do cleaning on a part-time basis at specific intervals (once or twice a week, or maybe at longer intervals) for part or all of a day. Duties are negotiated with each employer, sometimes on a day-to-day basis, and frequently there is no supervision, as, for example, when the employer works away from home during the day and the employee has her own key to let herself into the home or apartment.

Most household workers are employed part time. Full-time workers generally work at least 35 hours a week; those who live in usually work longer hours. There is some seasonal demand for dayworkers during holiday seasons; the demand for other workers remains steady throughout the year, but slackens somewhat during the summer vacation months.

### Where To Go for More Information

Information about employment opportunities in private-household work or about available training programs may be obtained from the local office of the State employment service.

Additional information on training can be obtained from:

National Committee on Household Employment,  
1346 Connecticut Ave. NW., Wash-  
ington, D.C. 20036.

### FBI SPECIAL AGENTS

(D.O.T. 375.168)

### Nature of Work

Federal Bureau of Investigation (FBI) Special Agents investigate many types of violations of Federal

laws, such as bank robberies, kidnappings, frauds against the Government, thefts of Government property, espionage, and sabotage. The FBI, which is part of the U.S. Department of Justice, has jurisdiction over more than 170 Federal investigative matters. Special Agents may be assigned to any type of case, but those 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.

The FBI is a fact-gathering and fact-reporting agency, and its Special Agents function strictly as investigators. (Its authority does not include affording personal protection to individuals nor does it include police functions to assure that the law is

obeyed. Such matters are within the purview of local and State law enforcement agencies.) To perform their duties, Special Agents may interview people, observe the activities of suspects, and participate in raids; their duties may involve extensive travel. Because of the highly confidential nature of the FBI's work, Special Agents may not disclose any of the information which they gather in the course of their official duties to unauthorized persons, including members of their families. Special Agents may have to testify in court about cases that they investigate, but they do not make recommendations pertaining to prosecution, express opinions concerning the guilt or innocence of suspects, nor issue "clearances" of any kind.



FBI Special Agent photographs evidence of scene of crime.

In most assignments, Special Agents work alone but must maintain continued contact with their superiors by radio or telephone. For potentially dangerous duties, such as arrests and raids, two agents or more are assigned to work together.

### Where Employed

Most of the 6,500 Special Agents employed in 1966 were assigned to the FBI's 57 field offices located throughout the Nation and in Puerto Rico. These agents work either in the city where the field office headquarters is located or in resident agencies (suboffices) established under the supervision of the field office to provide prompt and economic handling of investigative matters arising throughout the field office territory. Some agents are assigned to the Bureau headquarters staff in Washington, D.C., which supervises all FBI activities.

### Training, Other Qualifications, and Advancement

To be eligible for appointment as an FBI Special Agent, an applicant must have graduated from a State-accredited resident law school or a 4-year resident college with a major in accounting. The law school training must have been preceded by at least 2 years of resident undergraduate college work. Accounting graduates must also have had at least 3 years of experience in accounting or auditing or a combination of both.

Applicants for the position of FBI Special Agent must be male citizens of the United States, at least 23 and not more than 40 years of age, and willing to serve anywhere in the United States or Puerto Rico. They must be at least 5 feet 7 inches tall and capable of strenuous physical exertion; they must have excellent hearing and vision, normal color perception, and no physical defects which would prevent their using firearms or participating in dangerous assign-

ments. Each applicant must pass a rigid physical examination, as well as written and oral examinations testing his knowledge of law or accounting and his aptitude for meeting the public and conducting investigations. All of the tests except the physical examinations are given by the FBI at its facilities. Exhaustive background and character investigations are made of all applicants. Appointments are made on a probationary basis and become permanent after 1 year of satisfactory service.

Each newly appointed Special Agent is given approximately 14 weeks of training before he is assigned to a field office. He receives most of this training at FBI headquarters at Washington, D.C., and the rest at the FBI Academy at the U.S. Marine Corps Base in Quantico, Va. During this period, he receives intensive training in defensive tactics and firearms. In addition, he is also thoroughly schooled in Federal criminal law and procedures, FBI rules and regulations, fingerprinting, and investigative work. After assignment to a field office, the new agent usually works closely with an experienced agent for a period of about 2 weeks before handling any assignments independently.

All administrative and supervisory positions are filled from within the ranks by selecting those FBI Special Agents who have demonstrated the ability to assume more responsible positions.

### Employment Outlook

The FBI provides a career service, and its rate of personnel turnover is traditionally low. Nevertheless, the FBI is always interested in applications from qualified men who would like to be considered for the position of Special Agent.

### Earnings and Working Conditions

The entrance salary for FBI Special Agents as of mid-1966 was \$8,421

a year. FBI Special Agents are not appointed under Federal Civil Service regulations, but, like other Federal employees, they receive periodic with-in-grade salary raises if their work performance is satisfactory, and they can advance in grade as they gain experience. The top salary for regular field Special Agents as of mid-1966 was \$16,905. Agents in supervisory and administrative positions received higher salaries.

Special Agents are subject to call 24 hours a day and must be available for assignment at all times and places. They frequently work longer than the customary 40-hour week and, under certain specified conditions, receive overtime pay up to a maximum of \$1,269 a year. They are granted paid vacations, sick leave, and annuities on retirement.

### Where To Go for More Information

The Federal Bureau of Investigation,  
U.S. Department of Justice, Wash-  
ington, D.C. 20535.

## FIREFIGHTERS

(D.O.T. 373.118 through .884)

### Nature of Work

Firefighters help protect us from a hazard that—even with protection—costs thousands of lives and millions of dollars in property damage each year. Without their services, the loss of life and property from fires would be even greater. This statement gives information about firefighters who are full-time, paid employees of city and town fire departments. It does not cover the work in thousands of small communities by part-time volunteer firemen and others who serve only when the alarm signals that they are needed at a fire.

During their hours on duty at the fire station, firefighters must be prepared, at a moment's notice, to go to

a fire and handle whatever emergency they find. Because firefighting is dangerous and complicated, it must be well organized. At every fire, each firefighter performs a specific job assigned to him by a commanding officer; he may connect hose lines to hydrants, operate a pressure pump, position ladders or perform some other duty. Furthermore, depending on the judgment of the officer in charge, the assigned duties of a firefighter may be changed several times while his company is in action. Firefighters must therefore be proficient in many different kinds of firefighting activities, as well as capable of helping people to safety, administering first aid, and taking care of other emergencies as they arise.

Fire prevention is another important responsibility of city fire departments. In big departments specially trained personnel do fire prevention work, but in most cities regular firefighters perform this work. They inspect factories, theaters, and other public buildings for conditions that might cause a fire and for compliance with local regulations relating to fire escape, fire doors, storage of flammable materials, and other possible hazards. Educating the public about fire prevention and safety measures is also a part of the firefighters' job. Frequently they speak on this subject before school assemblies and civic groups. In many communities, they regularly inspect private homes, at the owner's request, in an effort to prevent fires by pointing out possible hazards to homeowners.

Between alarms, firefighters spend considerable time at their local stations, improving their knowledge of firefighting and doing maintenance work. They study fire manuals and textbooks in order to prepare for promotional examinations. They also participate in practice drills, clean and lubricate firefighting equipment, stretch hose to dry, stand watch at fire alarm instruments, and verify and record alarms.



### Where Employed

The number of full-time firefighters employed in 1967 by city fire departments is estimated at approximately 190,000. In addition, thousands of paid "call men" and hundreds of thousands of part-time volunteer firemen are organized in small towns and rural communities throughout the Nation to help fight fires. A few very large cities have several thousand firemen, while some small cities have fewer than 25.

### Training, Other Qualifications, and Advancement

To become eligible for an appointment as a firefighter, an applicant must pass a written intelligence test, a medical examination, and tests of strength, physical stamina, and agility, 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, and have a high school education. The men who receive the highest grades on their examinations have the best chances for appointment. Extra credit is usually given for military service. Experience gained as a volunteer fireman or through firefighting training in the Armed Forces may also improve chances for an appointment.

As a rule, beginners in large fire departments are given training for several weeks at the city's fire school. Through classroom instruction and practice drills, the recruits study such fundamentals as firefighting techniques, local building codes, fire prevention, and first aid; and learn about the use of axes, chemical extinguishers, ladders, and other firefighting equipment. Upon completion of this training, they are assigned to local fire companies. Opportunities for promotion are good in most fire departments. Fire departments generally fill higher positions by promotion from within. As firefighters gain experience, they may be advanced to progressively higher ratings and, after 5 to 10 years or more of service, become eligible for promotion to the grade of lieutenant. The line of further promotion is usually to captain, then battalion chief, assistant chief, and finally to chief. Chances for advancement generally depend upon each candidate's position on the promotion list, as determined by his rating on a written examination, his work as a fireman, and his seniority. Throughout their service, many firefighters continue to study fire prevention and related subjects, in order to improve their performance on the job and prepare for promotional examinations. Programs conducted by many State governments and city fire departments throughout the country provide training of this kind for tens of thousands of firefighters each year. Some universities offer courses in fire engineering.

Among the important personal qualities for firefighters are mental alertness, courage, mechanical apti-

tude, and endurance. Initiative and good judgment are extremely important because firefighters must often make quick decisions as situations change while companies are in action. Leadership qualities are valuable assets for officers, who have the responsibility for establishing and maintaining a high degree of discipline and efficiency, as well as planning and directing the activities of the firefighters in their companies.

### Employment Outlook

More than 10,000 openings for firefighters are expected to occur each year during the remainder of the sixties and through the 1970's. Many 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, largely because firefighters are often permitted to retire at an earlier age than people in many other occupations. New jobs will also become available as city fire departments enlarge their staffs and as paid departments replace volunteer fire companies in smaller, growing communities. In addition, some openings will probably be created as city fire departments continue to shorten the scheduled hours that individual firemen are on duty.

The number of young men who qualify for the firefighter jobs in large cities is usually greater than the number of job openings, even though the written examination and physical requirements eliminate many applicants. Competition among candidates is apt to be particularly keen when there is considerable unemployment, since employment in this occupation is very stable.

The number of firefighters is expected to increase very rapidly to meet the needs for fire protection in growing urban communities. As cities become more crowded, however, officials will give more emphasis to activities associated with fire prevention and many firefighters will spend a greater amount of their time in-

specting buildings for compliance with fire regulations and participating in fire prevention campaigns.

### Earnings and Working Conditions

In 1965, the average (median) annual entrance salaries for firefighters ranged from a low of \$4,713 in small cities (10,000 to 25,000 population) to \$5,794 in cities with populations of 250,000 to 500,000, according to the most recent study by the International City Managers Association. Generally, firefighters receive annual salary increases during the first 2 to 5 years of service.

Maximum salaries ranged from an average of \$5,304 in small cities to \$6,960 in large cities. For fire chiefs, the average salary ranges from \$7,124 in small cities to \$17,500 in large cities. Practically all fire departments furnish pay allowances for protective firefighting clothing (helmets, boots, and rubber coats) and many also provide dress uniforms.

In some cities, firemen are on duty for a 24-hour shift, and then off for 24 hours, with an extra day off at intervals. In other cities the day shift is 10 hours, and the night shift is 14 hours, with firemen rotating shifts at frequent intervals. Firemen's scheduled hours range from 40 hours a week in some cities to 96 hours in others; many observe a workweek of between 56 and 60 hours. The scheduled workweek in metropolitan centers with large fire departments tends to be considerably shorter than in small communities. Scheduled hours on duty usually include some time when firemen are free to read, study, or pursue other personal interests.

In addition to their scheduled hours, firefighters must work as many extra hours as necessary to bring a fire under control. When overtime is worked, most city fire departments either give compensatory time off or extra pay for the additional hours.

The job of a firefighter involves risk of life or injury from sudden cave-ins of floors or toppling walls, as well as hazards associated with expo-

sure to flames, smoke, and bad weather. In fighting fires in industrial establishments firefighters may come in contact with poisonous, flammable, and explosive gases and chemicals.

Firefighters are generally covered by liberal pension plans, many of which provide for retirement at half pay at age 50 after 25 years of service, or at any age if disabled in the line of duty. Firefighters also receive regular paid vacations. Provisions for sick leave are usually very liberal; health and surgical benefit plans are offered in many fire departments; and compensation is also provided for firefighters injured in the line of duty. Most fire departments either allow paid holidays—ranging up to 11 or more a year—or time off for working on holidays.

Many firefighters are members of the International Association of Fire Fighters (AFL-CIO).

### Where To Go for More Information

Information on how to obtain a job as a firefighter may be secured from your local civil service commission or fire department.

General information on the occupation may be obtained from:

International Association of Fire Fighters,  
905 16th St. NW., Washington, D.C.  
20006.

International Association of Fire Chiefs,  
232 Madison Ave., New York, N.Y.  
10016.

Additional information on the salaries and hours of work of firemen in various cities is published by The International City Managers Association in its *Municipal Yearbook*, available in many libraries.

## POLICEMEN AND POLICEWOMEN

(D.O.T. 375.118 through .868)

### Nature of Work

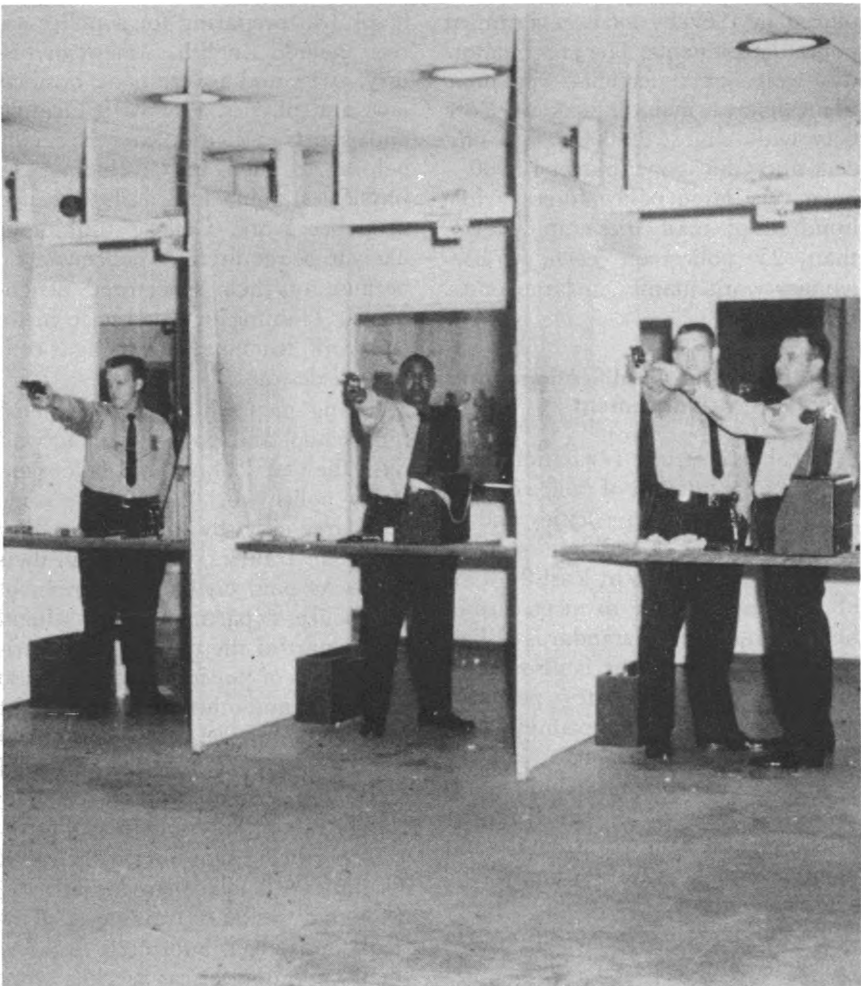
Police officers—whether directing traffic at busy intersections or arrest-



ing dangerous criminals—are helping to preserve law and order. As local government employees, their job is to prevent criminal activities, to investigate crimes, and to apprehend and assist in the prosecution of offenders. Whether on or off duty, they are expected to exercise their authority whenever necessary. (This report covers policemen and policewomen employed by local governments. It does not include civilian employees of police departments; State and Federal Government police employees; or policemen and detectives employed by private businesses.)

The policeman who works in a small community customarily handles many kinds of police duties. He may, for example, direct traffic at the scene of a fire, investigate a house-breaking, and give first aid to an accident victim—all in the course of a day's work. In a large police department, officers are usually assigned to a specific type of police duty. Most policemen are detailed either to patrol or traffic duty; smaller numbers are assigned to special work, such as accident prevention or operating radio and other communications systems. Some officers are detectives (plainclothesmen) assigned to criminal investigation, and others are experts in chemical and microscopic analysis, firearms identification, handwriting and fingerprint identification, and other investigative specialties. In very large cities, a few officers may be specially trained for work with mounted and motorcycle police, harbor patrols, helicopter patrols, canine crops, mobile rescue teams, or other special units.

An increasing number of city police departments are including women on their police forces. Policewomen are usually assigned to work which involves women and young people. They may, for example, work with juvenile delinquents, try to locate lost children and runaways, or search, question, book, and fingerprint women prisoners. Less frequently, they are assigned to detective squads, where they work mainly on crimes in-



Police recruits learn to use firearms.

volving women. Policewomen are almost never assigned traffic duty.

Most newly recruited policemen begin on patrol duty, which has become particularly important as a means of preventing crime and providing other services to the public. Patrolmen may be assigned to congested business districts, outlying residential areas, or other sections of a city; they may cover their beats alone or with other patrolmen; and they may ride in a police vehicle or walk on "foot" patrol. In any case, they become thoroughly familiar with conditions throughout their area and, while on patrol, remain alert for anything out of the ordinary. They note suspicious circumstances, such as open windows or lights in vacant

buildings, as well as hazards to public safety, such as burned-out street lights or fallen trees. Patrolmen also may watch for stolen automobiles and enforce traffic regulations. They report to police headquarters at regular intervals through call boxes or by radio, giving and receiving information about any situations which require action. They also prepare and turn in reports about their activities, and, in cases which result in legal action, they may be called upon to give testimony in court.

**Where Employed**

An estimated 275,000 full-time policemen and policewomen were em-

ployed in 1967 by local government police departments. The great majority—well over 95 percent—were men. Some cities—including New York City with almost 28,000 police officers, and Chicago with over 10,000—have very large police forces, while hundreds of small cities employ fewer than 25 policemen each. Policewomen work mainly in large cities.

### **Training, Other Qualifications, and Advancement**

Local civil service regulations govern the appointment of police officers in practically all large cities and in many small ones. Candidates must be U.S. citizens, usually at least 21 years of age, and be able to meet certain height and weight standards. Eligibility for appointment is also determined by the candidates' performance on competitive examinations, their physical and personal qualifications, and their education and experience. The physical examinations often include tests of strength and agility. Also, because personal characteristics such as honesty, good judgment, and a sense of responsibility are especially important in police work, candidates are usually interviewed by a senior officer at police headquarters, and their character traits and background also may be investigated.

Some police departments accept men with less than a high school education as recruits, particularly if they have had work experience in a field related to law enforcement. In large police departments, where most jobs are to be found, applicants must usually have at least a high school education. A few cities require some college training, and some hire law enforcement students as police interns.

Police departments are placing increasing emphasis on post-high school training in subjects such as sociology, psychology, and minority group relations with the result that more than 100 colleges and universities now offer major programs in law enforcement. Other courses—high school as well as college—which are considered

helpful in preparing for a police career include English, American history, civics and government, business law, and physics. Physical education and sports activities are especially helpful to men in developing the physical stamina and agility needed in police work. College training is likely to be required for policewomen, because of their specialized assignments. Training or experience in social work, teaching, or nursing is considered desirable.

Young men who have completed high school and do not want to wait until they are 21 years old before entering police work can start in some very large cities by working as police cadets, or trainees, while still in their teens. As paid civilian employees of the police department, they attend classes part of the time to learn various aspects of police science, and also do clerical and other nonenforcement work. When police cadets or trainees reach the age of 21—and provided they qualify in other respects—they may be appointed to the police force.

Before being sent out on their first assignments, policemen usually go through a period of training. The instruction is given informally in many small communities, as recruits work for a week or so with experienced officers. More extensive training, such as that provided in large city police departments, may extend over a period of several weeks or a few months and includes classroom instruction in constitutional law and civil rights, as well as in State laws and local ordinances, and in the procedures to be followed in accident investigation, patrol, traffic control, and other police work. Recruits learn how to use a gun, defend themselves from attack, administer first aid, and deal with other emergencies.

Policemen and policewomen generally become eligible for promotion after completing specified periods of service on the force; and in a large department, this may open the way for an officer to specialize in one of several kinds of law enforcement activities—laboratory work, traffic control, communications, work with ju-

veniles, and many others. Promotions to the rank of sergeant, lieutenant, and captain are made in accordance with each candidate's position on a promotion list, as determined by his performance on written examinations and his work as a police officer. Opportunities to advance are generally most numerous in large police departments, where the work is carried on in separate bureaus under the direction of administrative officers and their assistants. Most top ranking positions are occupied by men. Opportunities for women to advance beyond the rank of sergeant are mainly in the few police departments which have separate bureaus for women and juveniles.

Many types of training are available to help police officers improve their performance on the job and prepare themselves for advancement. Through training given at police department academies, and at colleges and other institutions, officers have opportunities to become informed or keep abreast of such varied subjects as crowd-control techniques, civil defense, legal developments which affect policemen, the interrogation of suspects and witnesses, and the advances in electronic and other types of equipment being developed as an aid to law enforcement. Many police departments encourage officers to work toward college degrees, and some pay all or part of the tuition.

### **Employment Outlook**

During the rest of the 1960's and through the 1970's, an estimated 15,000 opportunities will occur each year for qualified candidates to enter police work. Thousands will be new positions which arise as cities increase the size of their police forces to meet the needs of a growing population. Most openings, however, will be vacancies that occur as policemen and policewomen retire or leave their jobs for other reasons. Police officers usually retire at a somewhat younger age than workers in most other occupations, and replacement rates are relatively high for this reason.

Police employment is expected to rise moderately during the next 10 years, as population and economic growth create a need for more officers to protect life and property, regulate traffic, and provide other police services. The kinds of police jobs that arise in the future are likely to be affected to a considerable degree by changes now taking place in police methods and equipment. Specialists are becoming more and more essential in the effective operation of modern city police departments. In an increasing number of departments, for example, electronic data processing is being used to compile administrative, criminal, and identification records. There is a greater need also for officers with specialized training, as engineering techniques are applied to traffic planning and control and social work techniques are used in crime prevention. At the same time, relatively fewer officers are required for routine assignments, such as directing traffic, because of the use of automatic signal lights to control traffic at busy intersections.

Although the vast majority of new jobs that arise will be for men, many openings will occur for women also.

### Earnings and Working Conditions

In 1966, entrance salaries for police officers ranged from less than \$3,000 a year in some small cities to almost \$7,500 in several large ones, according to a report on salaries issued by The International City Managers' Association. The average (median) entrance salary in middle-size cities (50,000 to 100,000 population) was about \$5,500 a year.

Most policemen and policewomen receive regular pay increases during the first few years of employment, until a specified maximum is reached. Sergeants, lieutenants, and captains are paid progressively higher basic salaries than patrolmen in the same police departments. Top salaries are paid to police chiefs or commissioners, and in 1966 their salaries ranged from

less than \$5,000 a year in some small cities to more than \$35,000 in the largest cities.

Police departments usually provide officers with special allowances for uniforms, and furnish revolvers, night sticks, handcuffs, and other equipment required.

The scheduled workweek for police officers is usually 40 hours, and in localities where the workweek is longer—weekly hours are being gradually reduced. Police protection must be provided round the clock, and, in all but the very smallest communities, some officers are usually on duty over weekends, on holidays, and at night. Policemen are subject to call at any time their services may be needed and in emergencies may work overtime. Overtime, in some departments, is paid at straight time or time and a half; in others, officers may be given an equal amount of time off on another day of the week.

Police officers are generally covered by liberal pension plans, under which many are able to retire at half pay by the time they reach age 55. Paid vacations, sick leave, and medical, surgical, and life insurance plans are among the other benefits frequently provided.

Policemen may be assigned to work outdoors for long periods in all kinds of weather. The injury rate is higher than in many occupations and reflects the risks police officers take in pursuing speeding motorists, capturing lawbreakers, and dealing with disorderly conduct cases.

### Where To Go for More Information

Information about local entrance requirements may be obtained from local civil service commissions or police departments.

Additional information on the occupations of policemen and policewomen may be obtained from:

International Association of Chiefs of Police,  
1319 18th St. NW., Washington,  
D.C. 20036.

International Association of Women Police,  
100 North LaSalle St., Chicago, Ill.  
60602.

Additional information on the salaries and hours of work of policemen in various cities is published by The International City Managers' Association in its *Municipal Yearbook*, available in many libraries.

### STATE POLICE OFFICERS

(D.O.T. 375.118, .138, .168, .228,  
.268, and .388)

#### Nature of Work

State policemen (sometimes called State highway patrolmen or troopers) are protective service officers whose primary responsibility is to enforce the laws and regulations governing the use of highways. Officers spend most of their time patrolling highways to insure that traffic laws are obeyed. They issue warning or traffic tickets to motorists who violate the laws. When necessary, they make arrests and testify in court.

Another important duty of State police officers is to assist at the scene of an accident. They give first aid to injured persons, summon ambulances and other emergency equipment, and direct traffic to avoid additional accidents. Patrolmen conduct investigations of accidents, and write reports that include such information as weather conditions and causes of the accident. They make damage estimates and execute drawings of the accident scene. This information may be used as legal evidence.

State police officers also provide services to motorists on the highways. For example, they assist travelers in changing a tire, radio for road service in case of mechanical trouble, direct tourists to their destination, or provide information about lodging, restaurants, and tourist attractions.

An additional duty of State police officers includes providing traffic assistance and control during road re-



The smallest (in Nevada) has fewer than 100.

### Qualifications, Training, and Advancement

State civil service regulations govern the appointment of all State police officers. Candidates must be citizens of the United States. Other entry requirements vary by State, although applicants usually must be at least 21 years of age. Most States require a high school education or an equivalent combination of education and experience.

State police officers must pass a competitive examination and meet physical and personal requirements. Physical requirements include standards of height, weight, and eyesight. Often, test of strength and agility are required. Personal characteristics, such as honesty, good judgment, and sense of responsibility, are especially important in police work. Thus, investigation of an applicant's character traits and background is necessary.

In all States, recruits enter a formal training program that extends over a period of several months. The minimum period of training usually is 12 weeks. Recruits receive classroom instruction in State laws and jurisdictions. They also study procedures to be followed in accident investigation, patrol, traffic control, and other police work. They learn to use a gun, defend themselves from attack, handle an automobile at high speeds, administer first aid, and deal with other emergencies. After gaining experience, some State police officers take advanced or specialized training in police science, administration, law enforcement, or criminology. Classes are held at junior colleges, colleges and universities, or special police institutions such as the National Academy of the Federal Bureau of Investigation.

High school and college courses in English composition, reading comprehension, American history, civics and government, psychology, sociology, and physics are considered help-

pairs, fires, and other emergencies. Patrolmen also provide assistance for special occurrences such as parades, celebrations, and sporting events. They sometimes check the weight of commercial vehicles, conduct driver examinations, and serve as public safety information officers.

In some States, State policemen may investigate crimes such as thefts, murders, and narcotics violations. The jurisdiction of State police is usually limited to those areas that do not maintain their own police forces. However, they sometimes are requested to assist municipal or county police forces in the investigation of crimes, the apprehension of criminals, and the control of civil disturbances and riots.

Some police officers spend part or all of their time in specialized work. Fingerprint classification, chemical or microscopic analysis, instruction of trainees in State police schools, and

piloting police aircraft, are examples. Some work with special units, such as mounted police, canine corps, and harbor patrols.

State police officers also have administrative duties. They prepare reports and maintain police records. Some officers have broader administrative responsibilities with the State police agency. They may, for example, be chief of a division or bureau responsible for training or investigation, or they may command all police operations in an assigned area.

### Where Employed

An estimated 30,000 State police officers—virtually all men—are employed throughout the 49 States that maintained a police force in 1967. The size of State police forces varies considerably. The largest force (in California) has almost 3,000 officers.

ful in preparing for a career in police work. Physical education and sports activities are useful, for they develop needed stamina and agility. Completion of a driver education course also is beneficial. In addition, training received in military police schools is an asset to persons interested in State police careers.

Police officer recruits must serve a probationary period ranging from 6 months to 2 years, and occasionally to 3 years. After a specified period of time, State police officers become eligible for promotion. Most States have merit promotion systems that require officers to pass a competitive examination to qualify for the next highest rank. Although the organization of State police forces differs among States, the typical avenue of advancement is from private, to corporal, to sergeant, to first sergeant, to lieutenant, and then to captain. If police officers demonstrate administrative ability, they may be considered for higher level positions, such as commissioner or director.

High school graduates who do not want to wait until they are 21 years old before entering police work can, in some States, become police cadets. As paid civilian employees of the police organization, they attend classes to learn various aspects of police work. They are also assigned clerical, communications, and other nonenforcement duties. At age 21, cadets may be appointed to the State police force if they qualify.

### Employment Outlook

Employment opportunities for State police jobs are expected to be excellent for qualified applicants. Although the number of job applicants in many States exceeds the number of job openings, many applicants cannot meet the State civil service and other entry requirements.

State police employment is expected to rise very rapidly through the 1970's. More than 1,000 job openings are expected to result each year from growth in employment requirements,

and an even greater number will stem from the need to replace officers who retire, die, or otherwise leave the occupation.

Additional State police will be needed in criminal investigation and other nonhighway functions. However, most of the increasing need will be for highway patrol and related activities. This is the result of a growing and more mobile population. Along with an increasing number of motor vehicles, the nature of highway systems is also rapidly changing. Limited access highways require increased police patrol to control high speeds, prevent accidents, and assist stranded motorists. Also, the newer dual highways require more patrolmen, since officers can effectively patrol only one side of such highways.

Law enforcement work is becoming more complex. Thus, future police officers will need increased training in areas such as scientific criminal investigation and police administration. Some specialists will be needed to work in crime laboratories and electronic data processing centers that are being used to create better administrative, criminal, and identification information systems.

### Earnings and Working Conditions

In mid-1966, entrance salaries for State policemen ranged from \$370 to \$684 per month, according to a private survey. The most common entry rates ranged from \$400 to \$500 per month. Average monthly starting rates are highest in the Western States and lowest in the South.

State policemen generally receive regular salary increases, based on experience and performance, until a specified maximum is reached. The mid-1966 maximums ranged from \$480 to \$821 a month; most ranged between \$500 and \$700 a month. Their earnings may also increase above these levels as they are promoted to a higher rank, such as corporal or sergeant.

State police agencies usually provide officers with uniforms, firearms,

and other necessary equipment, or furnish special allowances for their purchase.

In many States, the scheduled workweek for police officers is 40 hours. In some States, the workweek is longer, but weekly hours in excess of 40 are gradually being reduced. Police protection must be provided around the clock. Thus, some officers are on duty over weekends, on holidays, and at night. Police officers are subject to emergency calls at any time.

State police are usually covered by liberal pension plans. Paid vacations; sick leave; and medical, surgical, and life insurance plans frequently are provided.

The work of police officers is sometimes hazardous. There is always the risk of an automobile accident during pursuit of a speeding motorist or a fleeing criminal. Also, in quelling riots and apprehending criminals, a police officer faces the risk of bodily harm.

### Where To Go for More Information

Information about specific entrance requirements may be obtained from State civil service commissions or State police headquarters, usually located in each State capitol.

Additional information on the occupation of policeman may be obtained from:

International Association of Chiefs of Police,  
1319 18th Street NW., Washington,  
D.C. 20036.

### COOKS AND CHEFS

(D.O.T. 313.131 through .887; 314.381 through .878; and 315.131 through .381)

### Nature of Work

Every one of the millions of people who eat meals away from home each day appreciates the work of a good cook—or chef, as an expert in this



Student cooks learn roasting skills.

fry cook, roast cook, vegetable cook, or sauce cook, for example. The head cook or chef—or, in a large restaurant or hotel, the executive chef—who coordinates the work of the kitchen staff is almost always a highly skilled cook and may often take direct charge of certain kinds of food preparation. He decides on the size of the food portions served and sometimes plans menu items and purchases food supplies. In addition, he has the important responsibility of seeing that the dishes served taste good and are attractive in appearance. Because of their skill in creating new dishes and improving the flavor of familiar ones, some chefs who rank at the top in this occupation have acquired national and international reputations for themselves and for the restaurants and hotels where they work.

### Where Employed

About 650,000 cooks and chefs were employed in early 1967. Most of these workers were restaurant cooks, but large numbers were employed in public and private schools and in hotels and hospitals. Railroad dining cars, ocean liners, government agencies, manufacturing plants, private clubs, and many other kinds of establishments also employed cooks and chefs.

Three out of every five of these workers were women. About half of the cooks in restaurants and the great majority of those employed in schools and hospitals were women. Men outnumbered women in hotels and private clubs, aboard ships, and on railroad dining cars. Also, most head cooks and practically all chefs were men.

### Training, Other Qualifications, and Advancement

Most cooks—particularly those who work in small eating places—acquire their skills on the job while employed as kitchen helpers. Less frequently, they are trained as ap-

profession is often called. A restaurant's success as a business enterprise depends in large part on the skill of the workers who prepare the dishes served. Hotels, railroads, and many other enterprises that serve meals also are judged at least partly on the same basis. This statement discusses the work of cooks and chefs employed in business establishments and institutions. It does not cover cooks who work in private homes.

The nature of a cook's job depends partly on where he works. There is a good deal of difference, for example, in preparing food for students in a high school cafeteria, for passengers on a jet airliner, or for patients in a hospital. Similarly, the "home cooking" which is the trademark of many small establishments is far different from the elaborate cuisine featured in some cosmopolitan restaurants; and the cook who works in a steak

house prepares food that is quite different from that prepared by the cook in a restaurant which serves Chinese dishes.

Equally important, from the standpoint of a cook's duties, is the size of the establishment in which he works. In many small restaurants, one cook—perhaps aided by a short order cook and one or two kitchen helpers—prepares all the foods served. Often the menu consists of a few dishes prepared on a short order basis, plus pies and other baked goods purchased at a local bakery.

Large eating places are more likely to have varied menus, and to prepare on the premises all of the food served. The kitchen staff in a large establishment often includes several cooks—sometimes called assistant cooks—and many kitchen helpers. Each cook usually has a special assignment and often a special job title—pastry cook,

prentices under trade union contracts or the training programs which some large hotels and restaurants conduct for their new employees.

For work in some large restaurants and hotels, where hiring standards are often higher than in small establishments, young people usually will find it a distinct advantage to have had courses in restaurant cooking. Such training is offered in a growing number of schools and other institutions. Although the curriculum may vary, usually a major part of each student's time is spent in learning professional food preparation through actual practice in well-equipped kitchens. The student receives instruction in baking, broiling, and other methods of preparing food, and in the use and care of kitchen equipment. Instruction may also be given in selecting and storing food, determining the size of individual portions, planning menus, and buying food supplies in quantity, as well as in hotel and restaurant sanitation and the public health aspects of food handling.

Many vocational schools—both public and private—afford this kind of training for high school students. Other courses, open in some cases only to high school graduates and ranging from a few months to 2 years or more in length, are given under the auspices of restaurant associations, hotel management groups, and trade unions, and in technical schools and colleges. In addition, programs to train unemployed and underemployed workers for jobs as bakers and various types of cooks were operating in several cities in 1967 under provisions of the Manpower Development and Training Act. Many school districts also provide on-the-job training opportunities for cooks during the school year as well as in workshops during the summer months. Frequently, cooks for the many new schools opening each year are selected from those employees who have participated in workshops and who show the greatest aptitude for the work. These training programs usually are planned in

cooperation with the State Vocational Education Departments.

Advancement for a beginner may be to a different cooking assignment which requires more skill, or he may obtain a job in another establishment which pays more or offers him a better opportunity to learn new cooking skills. Acquiring the all-round skill necessary to qualify as an expert and eventually advance to a position as head cook or chef in a fine restaurant often takes many years. For those cooks with an exceptionally good background of training and experience, this occupation offers excellent prospects of reaching the top. A few experienced cooks eventually go into business for themselves as caterers or restaurant proprietors; others may become instructors at vocational schools and other institutions offering training in this occupation.

Cleanliness, the ability to work under pressure during busy periods, physical stamina, and a keen sense of taste and smell are among the important qualifications needed for this occupation. A cook or chef in a supervisory position not only must be an expert cook, but also must be able to organize and direct kitchen operations effectively. Health certificates, indicating that cooks and chefs are free from communicable diseases, are required by the laws of many States.

### Employment Outlook

This occupation is expected to offer excellent opportunities for employment during the remainder of the 1960's and throughout the 1970's. The number of cooks and chefs will probably rise rapidly, as new restaurants, hotels, and other establishments which serve food are opened. Most of the openings will become available as workers retire or leave their jobs for other reasons, however; retirements and deaths alone are expected to create more than 25,000 vacancies each year.

Small restaurants and other eating places where the food preparation is fairly simple will afford young people

the greatest number of opportunities to obtain starting jobs as cooks. Beginners—especially those who have taken training in restaurant cooking—also will find starting positions available in hotel and restaurant kitchens where foods are prepared more elaborately. The shortage of skilled cooks and chefs is acute and employment opportunities for well qualified beginners will be especially good.

A continued expansion in the business of serving meals away from home—and in the number of workers who prepare these meals—is expected, not only because of population growth, but also because of the relatively rapid increases which are likely among some groups in the population who customarily eat meals away from home. Large increases are expected in the number of young people entering jobs for the first time, the number of married women taking employment outside their homes, and the number of students attending schools and colleges. In hospitals and other institutions, a continued increase is foreseen in the number of patients, attendants, and others who regularly eat meals prepared on the premises. In addition, travel for business and pleasure is expected to increase; as a result, more people will be patronizing eating places.

### Earnings and Working Conditions

Limited wage data obtained from union-management contracts, in effect in early 1967, covering eating and drinking places in large metropolitan areas on the East and West Coasts and in the Midwest, provide an indication of earnings for cooks and chefs. In these contracts, straight-time hourly pay rates generally ranged from \$2.50 to \$3.80 for chefs; \$1.95 to \$3.25 for cooks of various types (such as pastry, fry, roast, and vegetable cooks); and \$1.50 to \$2.50 for assistant cooks. Many cooks and chefs are not covered by union-management contracts. Wages in this occupation also vary greatly according to geo-

graphical location and type of establishment. In large restaurants and hotels many cooks earn considerably more than the minimum rates. Head cooks and chefs in such establishments may earn up to \$15,000 annually; some chefs with national reputations make more than \$25,000 a year.

In addition to their wages, restaurant cooks usually receive at least one free meal a day at their place of work and are furnished with uniforms. Paid vacations and holidays are common, and various types of health insurance programs also are available. Scheduled hours in restaurants include late evening, holiday, and weekend work, and range from 40 to 48 a week, depending on the section of the country. Women and men employed in public and private schools work during the school year only—usually 9 months. The hours worked frequently coincide with the school hours.

Many of the kitchens in which these workers are employed are air conditioned, have convenient work areas, and are furnished with modern equipment and laborsaving devices. Others—particularly kitchens in small eating places—are often less well-equipped, and working conditions may be less desirable. In kitchens of all kinds, however, cooks often spend long periods on their feet and may be required to lift heavy pots and other objects, or work near hot ovens or ranges. Work hazards include the possibility of burns and scalds, and injury from knives, broken glass, or mechanical equipment.

The principal union organizing cooks and chefs is the Hotel & Restaurant Employees and Bartenders International Union.

### Where To Go for More Information

General information about restaurant cooks and chefs is available from the:

Educational Director, National Restaurant Association,  
153 North Lake Shore Dr., Chicago,  
Ill. 60610.

A list of public and private schools offering courses in cooking may be obtained from:

Council on Hotel, Restaurant, and Institutional Education,  
Statler Hall, Cornell University,  
Ithaca, N.Y. 14850.

## WAITERS AND WAITRESSES

(D.O.T. 311.138 through .878)

### Nature of Work

Whether they work in small lunchrooms or fashionable nightclubs, all waiters and waitresses have jobs that are essentially the same. They take customers' orders, serve food and beverages, make out customers' checks, and sometimes they take payments as well. The way waiters and waitresses go about their work may vary considerably, however, because food service in very small eating places differs from that in large ones; and service in restaurants that emphasize speed and efficiency is different from that where dining is formal and leisurely. (This statement covers the work of table waiters and waitresses employed in restaurants, hotels, and other eating places. Workers employed in private homes or counter waiters and waitresses in restaurants, hotels, and other establishments are not covered.)

Many thousands of eating places, such as those which are often patronized by working people on their lunch hours, emphasize quick service and a minimum of frills. In addition to waiting on tables, the waiters and waitresses in these establishments usually perform a variety of other duties associated with food service. Often they set up and clear tables, and carry dishes back to the kitchen; and sometimes, when the establishment is very small, they may combine waiting on tables with counter service, preparing sandwiches, or cashiering.

However, in most large restaurants and in places where meal service is

formal, waiters and waitresses are relieved of most of these additional duties associated with serving. In such establishments, busboys and busgirls often set up tables, keep water glasses filled, and perform other routine tasks, leaving the waiters and waitresses free to devote practically all of their time to taking guests' orders and seeing that meals are properly served. In those eating places where meals are served elaborately and a great deal of emphasis is placed on the satisfaction and comfort of each guest, a waiter may be called upon to advise about the choice of a wine or answer questions about the preparation of items on the menu. Sometimes, from a side table, he may prepare and serve salads to guests or flame certain dishes such as crepes Suzettes.

### Where Employed

More than 950,000 waiters and waitresses were employed in early 1967. The great majority—about 7 out of every 8—were women. The proportion of part-time workers was high. About 2 out of 5 were employed fewer than 35 hours a week.

Approximately four-fifths of all workers in this occupation were employed in restaurants, drugstores, and other retail establishments that serve food. Hotels and educational institutions of all kinds also employ many waiters and waitresses. Jobs for waiters tended to be concentrated in those restaurants, hotel dining rooms, private clubs, and other establishments where meal service is formal.

### Training, Other Qualifications, and Advancement

Although this occupation includes many workers who do not have extensive schooling, more and more employers prefer that beginners have at least 2 or 3 years of high school. Home economics courses and special courses for waiters and waitresses which are offered by some public and private schools provide good prepara-





vance to managerial positions in restaurant operation.

### Employment Outlook

Employment opportunities for waiters and waitresses are expected to be good during the remainder of the 1960's and throughout the 1970's. Most of the openings will occur as workers retire or leave their jobs for other reasons; retirements and deaths alone will create an estimated 45,000 openings each year. Turnover is particularly high in the many eating places which employ waitresses, because many women leave their jobs to take care of family responsibilities.

In addition to the vacancies that occur because of turnover, thousands of jobs will be created by employment growth, as the number of eating places increases to meet the needs of the country's growing population. Also contributing to an increased need for restaurant services are such factors as rising income levels; more travel, both for business and pleasure; and the expected increase in the number of housewives employed outside the home. Eating places which employ waiters and waitresses will probably share only part of the additional business created, however; some of it will be handled by the growing number of vending machines dispensing prepared foods, and some of it will go to the drug stores, limited price variety stores, and cafeterias where meal service is provided by counter and fountain workers. Nevertheless, the number of waiters and waitresses will probably rise rapidly through the 1970's.

Most of the job openings that arise because of growth and turnover will be for waitresses. The number of men in this occupation have been diminishing for some years, while at the same time jobs for waiters have become more concentrated in formal dining establishments; these trends are expected to continue. As in the past, both waiters and waitresses seeking employment in restaurants of this kind will find competition keen for

tion. Restaurant associations also offer training in this field. In addition, programs to train unemployed and underemployed workers for jobs as carhops, waiters, and waitresses were operating in several cities in 1967 under provisions of the Manpower Development and Training Act.

Practically all newly hired workers without previous experience as a waiter or waitress undergo a period of on-the-job training, during which they learn about the type of food service offered in their employer's establishment. Sometimes they work as busboys or busgirls before being assigned a station as a waiter or waitress.

Waiters and waitresses must be able to make the calculations necessary to total guests' checks and compute taxes. Personal appearance, a pleasant manner, an even disposition, and

the ability to cope with the rush of business that usually occurs at meal-times are very important. In a few restaurants, knowledge of a foreign language may be desirable. Waiters and waitresses are often required by State law to obtain health certificates in order to assure that they are free of communicable diseases. Physical stamina is also needed because they are on their feet during their working hours.

In many small eating places, opportunities for promotion are limited. However, after gaining experience, a waiter or waitress who starts in a job of this kind may transfer to a larger restaurant where earnings and prospects for advancement are likely to be better. Advancement may be to a position as cashier or to supervisory work as a headwaiter or hostess. Some supervisory workers eventually ad-

the jobs that become available; since there are relatively few such positions, hiring standards are high, and turnover is usually very low. Beginners will continue to find their best opportunities for employment in the thousands of establishments where food service is less elaborate.

### Earnings and Working Conditions

Because most waiters and waitresses receive tips from the guests they serve as well as wages paid by their employers, estimating average weekly earnings is difficult. Wages are generally lower than in other occupations, and the amount received in tips is usually somewhat greater than the wages paid. Tips vary greatly in amount, however, depending on the skill of the waiter or waitress, the tipping customs in the community, and especially on the type of restaurant. Because tips often average between 10 and 15 percent of guests' checks, earnings from tips are usually highest in restaurants where prices are also highest.

Limited wage data obtained from union-management contracts, in effect in early 1967, covering eating and drinking places in large metropolitan areas on the East and West Coasts and in the Midwest, provide an indication of earnings for waiters and waitresses. In these contracts, straight-time hourly pay rates generally ranged from \$.80 to \$1.80 for waiters and waitresses. Many waiters and waitresses are not covered by union-management contracts. Wages in this occupation also vary greatly according to geographical location and type of establishment.

In addition to wages and tips, the majority of waiters and waitresses receive free meals at their place of work. Many are also furnished with uniforms. Paid vacations after qualifying periods of service are customary, and various types of health, insurance, and pension plans may also be offered.

Waiters and waitresses often work split shifts—that is, they work for sev-

eral hours during the middle of the day, take a few hours off in the afternoon, and then return to their jobs for the evening hours. Scheduled hours include some work on holidays and weekends. Large restaurants and dining rooms are usually comfortably furnished, with convenient working areas, and are often air conditioned. Workers in other eating places—particularly small ones—may find working conditions less desirable and the pace of work very rushed at times. In restaurants of all types, workers often spend long periods on their feet, and may be required to lift heavy trays. Work hazards include the possibility of burns and cuts.

The principal union organizing waiters and waitresses is the Hotel & Restaurant Employees and Bartenders International Union.

### Where To Go for More Information

General information about restaurant waiters and waitresses is available from:

Educational Director, National Restaurant Association,  
1530 North Lake Shore Dr., Chicago,  
Ill. 60610.

### HOSPITAL ATTENDANTS

(D.O.T. 079.368 and .378;  
and 355.687 through .887)

#### Nature of Work

Hospital attendants are members of the nursing team which cares for people who are physically or mentally ill. Under the direction of registered professional nurses and licensed practical nurses, they perform a variety of duties, most of which require relatively little specialized training but all of which contribute to the comfort and care of their patients. The help provided by hospital attendants enables nurses to devote more time to work which requires professional and technical training.

Women employed as hospital attendants are usually called *nurse aids* and men are often known as *orderlies*. Other job titles which are used include *nursing assistant*, *auxiliary nursing worker*, and (in mental institutions) *psychiatric aid*. Among the tasks often performed for patients by nurse aids are answering call bells and delivering messages, serving meals, feeding patients who are unable to feed themselves, making beds, bathing or dressing patients, and arranging flowers. Duties may also include giving back rubs, taking temperatures, and assisting patients in getting out of bed and walking. Orderlies provide many of the same services for male patients and, in addition, perform such tasks as wheeling patients to operating and examining rooms, and transporting and setting up heavy equipment. Attendants may also be assigned to tasks less directly associated with patient care—for example, working in hospital pharmacies or helping with sterile supplies.

Other duties that may be performed by hospital attendants depend on the policies of the institutions where they are employed, the type of patient being cared for, and—equally important—the capacities and resourcefulness of the nurse aid or orderly. In some hospitals, for example, the nurse aid's work includes household tasks such as cleaning patients' rooms, and in others it is limited to assisting in the care of patients. Even the tasks performed for patients may differ considerably, depending, for example, on whether the patient is confined to his bed following major surgery, or is learning to walk again after a severe accident or a disabling illness, or is infirm because of advanced age and requires assistance with the activities of daily living.

#### Where Employed

An estimated 700,000 hospital attendants were employed in 1966—more than three-fourths were women. About 500,000 worked in hospitals. The remainder were employed pri-

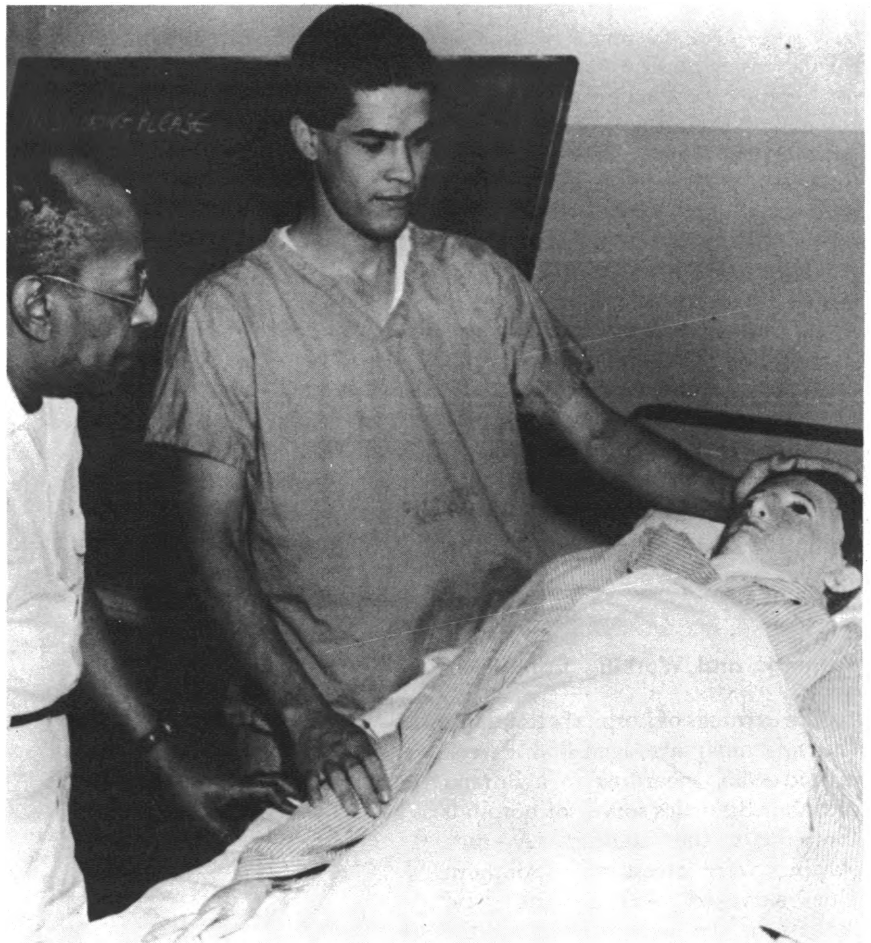
marily in sanitariums, nursing homes, and other institutions providing facilities for care and recuperation. Such establishments are found in every part of the country, but most opportunities for employment as nurse aids and orderlies are in heavily populated areas.

### Training, Other Qualifications, and Advancement

Although some employers hire persons with less than a high school education as hospital attendants, high school graduates are nevertheless preferred. Courses in home nursing and first aid, offered by many public school systems and other community agencies, provide a useful background of information for the work. Volunteer work and temporary summer jobs in hospitals and similar institutions may also furnish experience that is helpful. Training programs for hospital attendants are also offered under the provisions of the Manpower Development and Training Act.

Many employers accept applicants 17 or 18 years of age. Others—particularly in nursing homes and in mental hospitals—prefer to hire more mature men and women who are at least in their mid-twenties. All applicants for work of this kind should be in good health. Personal qualities such as tact, patience, understanding, emotional stability, and dependability are all important. For work as an attendant, as in other health occupations, a basic requisite is a genuine interest in people and a desire to be of help to them.

Hospital attendants are generally trained in their duties after they are hired. In some institutions, on-the-job training under the close supervision of registered and licensed practical nurses is combined with classroom instruction that includes demonstrations in taking and recording temperatures, bathing patients, changing linens on beds which are occupied by patients, moving and



Hospital attendant learns how to handle patient.

lifting patients, and other duties. Training may be continued over a period of several days or a few months, depending on the policies of the hospital, the attendant's aptitude for the work, and the nature of the duties assigned.

Promotional opportunities are limited for hospital attendants, unless they undertake further training. With specialized training, some may prepare themselves for better paying positions such as hospital operating room or oxygen technicians.

For employment as licensed practical nurses, hospital attendants must first complete the year of training usually required for licensure. (See statement on Licensed Practical Nurses elsewhere in the *Handbook*.)

### Employment Outlook

Employment of hospital attendants is expected to increase very rapidly through the 1970's. In addition to those needed for occupational growth, many thousands of hospital attendants will be needed each year to replace those who die, retire, or leave the occupation for other reasons.

Most of the new jobs that become available for nurse aids and orderlies during the remainder of the 1960's and through the 1970's will be in hospitals, but many openings will also occur in nursing homes, convalescent homes, and other long term care facilities. Among the reasons for expecting employment to rise are the increase in population, the increasing numbers of elderly people in the pop-

ulation—a group which is particularly susceptible to long term illness; the increasing ability of persons to pay for health care because of rising incomes and the growth of public and private health insurance plans; and the emphasis being placed on rehabilitation in mental hospitals and other institutions. Many additional jobs for aids and orderlies are expected because of Medicare and Medicaid and recent Federal legislation designed to increase the number of nursing homes. In addition, employment opportunities will arise as hospitals continue to have attendants perform tasks which, although associated with the care of patients, do not require the training of registered and licensed practical nurses.

### Earnings and Working Conditions

The earnings of hospital attendants (nursing aids) averaged \$58 a week in mid-1966, according to a Bureau of Labor Statistics survey of hospitals throughout the country. Average earnings were lowest in the southern cities surveyed (\$47 a week) and highest in the western part of the country (\$69). The averages were lower—by from \$5 to \$7 a week—for nurse aids than for orderlies employed in the same sections of the country. Hospital attendants employed full-time by nursing homes and related facilities averaged weekly earnings of \$45 in early 1965, according to another BLS survey.

In some institutions, free lodging may be furnished hospital attendants. Free meals, or meals at cost, as well as uniforms and laundering of uniforms, may also be provided hospital attendants in some institutions.

With few exceptions, the scheduled workweek of the attendants in the hospitals surveyed by the Bureau of Labor Statistics was 40 hours or less. Because nursing care must be available to patients on a 24-hour-a-day basis, scheduled hours include night-work and work on weekends and holidays.

According to the limited information available, those attendants who are employed in hospitals and similar institutions generally receive paid vacations which, after 1 year of service, may be a week or more in length. Paid holidays and sick leave, hospitalization and medical benefits, and pension plans are also available to many hospital employees.

### Where To Go for More Information

Information about employment opportunities and duties may be obtained from local hospitals and other health agencies.

Additional information about the work of hospital attendants may also be obtained from:

ANA-NLN Nursing Careers Program,  
American Nurses' Association,  
10 Columbus Circle, New York, N.Y.  
10019.

Division of Health Careers,  
American Hospital Association,  
840 North Lake Shore Dr., Chicago,  
Ill. 60611.

## BARBERS

(D.O.T. 330.371)

### Nature of Work

Barbers provide many services related to the care of hair, face, and scalp. Their main task, however, is to cut hair in accordance with the preference of each customer. They also give hair and scalp treatments, provide services such as shaves, facial massages, and shampoos, and fit hair pieces.

A barber builds a steady clientele by giving good haircuts, putting customers at ease, giving them efficient, courteous service, and keeping a clean, attractive shop. In a small shop, it may be part of his job to keep his own work area clean and sometimes sweep the shop. Usually, each barber is responsible for keeping his barbering instruments sterilized and in good

condition. Those who run their own shops have managerial responsibilities such as ordering supplies, paying bills, keeping records, and hiring employees.

### Where Employed

The total number of barbers employed in 1967 is estimated at about 207,000. The great majority were men. More than half of all barbers own and operate their own shops. Small shops, in which the owner either works alone or with one other barber, provide employment for the majority of workers in this occupation. Many barbers also work in large shops such as those in suburban shopping centers and in hotels and office buildings in downtown city districts. Some barbers work in combination barber and beauty shops, and a few for government agencies and in such places as hospitals, and on ocean liners.

All cities and towns and many very small communities have barbershops. However, employment is concentrated in large cities and in the most populous States.

### Training, Other Qualifications, and Advancement

In practically all States, barbers must be certified or licensed. To obtain their licenses, candidates must be graduates of State-approved barber schools. In addition, they must meet certain health requirements, usually be at least 16 (or 18) years old, and have completed at least the eighth grade. In all but a very few States, the beginner is required first to take an examination for an apprentice license; then, usually after working 1 or 2 years as an apprentice barber, he takes a second examination for his license as a registered barber. The examinations usually include both a written test and a demonstration of the applicant's ability to perform barbering services. The fees charged for these examinations generally range

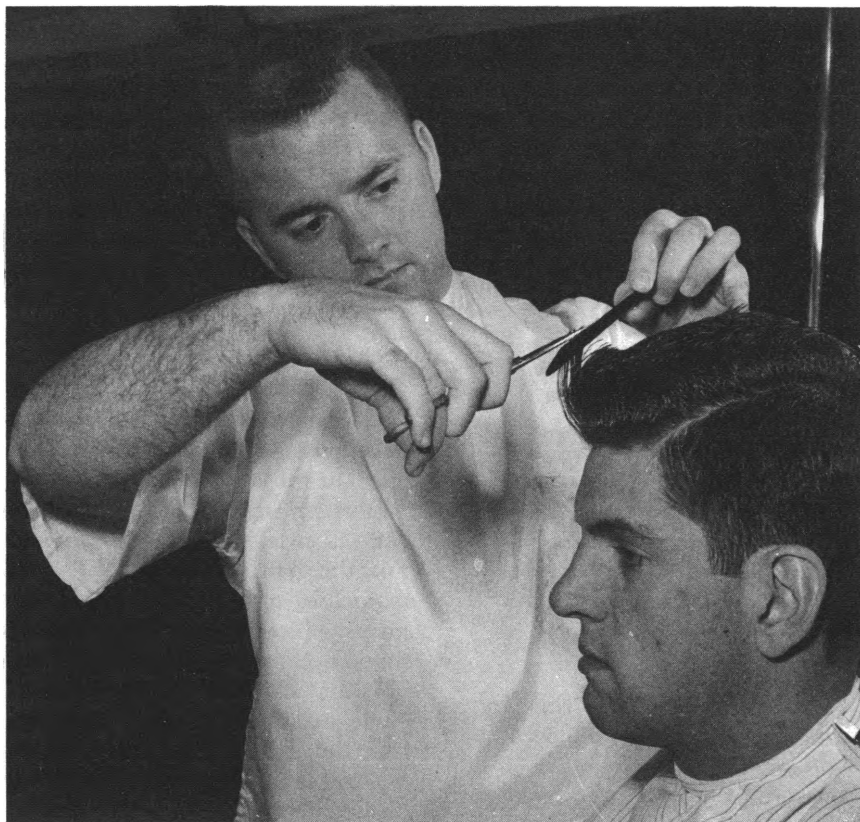
from \$5 to \$25. A few States do not require a fee for their apprentice examination. Barbers who move to another State must meet the licensing requirements of that State.

Barber training is offered in many public and private schools. Courses usually run from 6 to 9 months and include from 1,000 to 1,800 hours of instruction. A trainee studies the basic services—haircutting, shaving, massaging, and facial and scalp treatments—and, under supervision, practices these services on fellow students and customers in school “clinics.” Besides attending lectures on barber services and the use and care of barber’s instruments, the student takes courses in anatomy, sanitation, and hygiene, and learns how to recognize certain skin conditions. Instruction is also given in salesmanship and general business practices. Advanced courses are available in some localities for those registered barbers who wish to specialize in such areas as hair styling and coloring.

A beginner may locate his first job through the barber school he attended, or through the local barber’s union or employer’s association. He customarily purchases his own tools—often at a cost of \$100 or more.

Some experienced barbers advance themselves by becoming managers of large shops or by opening their own shops. A few, who meet the requirements, may become teachers at barber schools. Barbers who go into business for themselves must have the capital to buy or rent a shop and install equipment. The amount of capital needed differs, because some owners buy used equipment and fixtures at reduced prices, whereas others pay higher prices for new equipment. The cost of equipping a one-chair shop with new equipment is roughly estimated at from \$1,000–\$2,000.

Dealing with customers may require patience and a better-than-average disposition. Good health and stamina are important also, as a barber must stand for long periods, much of the time working with both hands at shoulder level.



### Employment Outlook

Several thousand openings for barbers are expected to arise each year during the remainder of the 1960's and throughout the 1970's. The majority will be positions that become vacant through turnover; retirements and deaths alone are expected to create more than 6,000 openings yearly. Replacement needs in this occupation are relatively high, because barbers are somewhat older, on the average, than workers in many other occupations. Openings also will occur as more barbering services are required to meet the needs of the growing population. The recent trend toward hair styling for men may result in additional job openings for qualified barbers.

A moderate rise in employment is anticipated over the long run. The small shop with only one or two barbers will probably remain the most common type of establishment; however, the continued growth of sub-

urban communities should result in opportunities to open large shops in these areas, and also to expand staffs in established shops.

### Earnings and Working Conditions

Employed barbers receive income from commissions or wages as well as from tips. Most barbers who are not in business for themselves are paid on a straight commission basis—normally 65 to 75 percent of the money they take in—and a few are paid straight salaries.

Weekly earnings of experienced barbers (including tips), generally ranged between \$110 and \$150 in 1967, according to the limited information available. A few expert barbers, as well as some barbers who operated their own shops, made more than \$200 a week. Apprentice barbers usually averaged about \$75 a week.

Earnings depend on such factors as the size and location of the shop, customers' income levels and tipping habits, competition from other barbershops, the barber's skill at his trade, his ability in attracting and holding regular customers, and the prices he can charge for his services. In 1967 for example, the cost of a haircut ranged from \$1 in some shops to more than \$2.25 in others.

Most full-time barbers work more than 40 hours a week; a workweek in excess of 50 hours is not uncommon. A barber may have to serve a steady stream of customers during peak hours and on especially busy days such as Saturdays, but during slack periods he may have time off to attend to personal matters. Under some union contracts, barbers receive 1- or 2-week paid vacations, insurance, and medical benefits.

The principal union which organizes barbers—both employees and shopowners—is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. The principal trade association which represents and organizes shopowners and managers is the Associated Master Barbers and Beauticians of America.

### Where To Go for More Information

Information on State licensing requirements may be obtained from the State Board of barber examiners or other State authority at each State capital; and information about approved barber schools, from the division of vocational education at each State capital.

General information on training facilities, and State licensing laws may also be obtained from:

National Association of Barber Schools, Inc.,  
750 Third Ave., Huntington, W. Va.  
25701.

Additional information on this occupation is also available from:

Associated Master Barbers and Beauticians of America,  
219 Greenwich Rd., P.O. Box 17782,  
Charlotte, N.C. 28211.

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America, 1141 North Delaware St., Indianapolis, Ind. 46207.

## COSMETOLOGISTS

(D.O.T. 332.271 and .381;  
331.878; and 339.371 and .878)

### Nature of Work

Cosmetologists provide a variety of beauty services, most of which are related to the care of hair. They give permanent waves, and they shampoo, cut, set, style, straighten, bleach, and tint the hair. They may also give manicures and scalp and facial treatments, provide makeup analysis, shape eyebrows, and clean and style wigs and chignons. Other duties include making appointments for patrons, cleaning the equipment they use, and sanitizing implements. Often, cosmetologists are called *beauty operators*, *hairdressers*, or *beauticians*.

Particularly in large salons, but in many small ones also, operators may specialize in different phases of the work. When they do, they often have job titles which relate to their

specialties—manicurist, tint specialist, or hair stylist, for example. Many of the men employed as cosmetologists are hair stylists.

The owner-operator of a beauty salon, in addition to working as an operator, usually performs a number of managerial duties, such as record-keeping, property maintenance, control of supplies, and supervision of employees.

### Where Employed

An estimated 475,000 people were employed as hairdressers and cosmetologists in 1967. More than 10 percent were men. The proportion of part-time workers is relatively high.

Most cosmetologists are employed in salons which are operated as independent establishments or in conjunction with hotels and department and specialty stores. Smaller numbers work in a variety of other establishments—for example, in motion picture and television studios, in hospitals, and on ocean liners.

Employment generally is concentrated in urban areas, although many operators work in small towns and rural areas in all parts of the country. The great majority of beauty salons are small establishments with fewer than four employees. More than half of all beauty salons are owner-operated.

### Training, Other Qualifications, and Advancement

All States require that beauty operators be licensed. Before applicants are eligible to take State licensing examinations in the theory and practice of cosmetology, they usually must be at least 16 years of age, present certificates of good health, and have completed at least the 8th grade—in many States the 10th, and in a few the 12th. Successful completion of a State-approved cosmetology course is recognized as adequate preparation for these examinations in all States;



in some, a period of apprenticeship may be substituted. More than three-fourths of the States provide for reciprocity, and therefore operators licensed to work in one State can often move to another and continue their work without taking an examination to qualify for another license.

More than 3,000 public vocational schools and private schools offer training which meets State licensing requirements for cosmetologists. In many of them, instruction preparing students for a general operator's license is available in evening classes as well as in full-time day classes. Many daytime courses offered by public and private schools require from 6 months to a year to complete. Other public school courses, which include academic subjects required for a high school diploma, last from 2 to 3 years. Apprentice training usually continues over a period of 1 or 2 years. Many States issue special manicurists' licenses which require substantially fewer hours of training than general operators' licenses.

Both public and private school training programs include classroom study, lectures, demonstrations, and practical work. Students who are beginners usually practice by working on each other or on manikins and, when they have satisfactorily completed a period of preliminary training, they may practice on patrons in school "clinics." Practically all beauty schools help their students find jobs after graduation.

Some cosmetologists start as manicurists or shampooers, while others begin as all-round operators performing a variety of services. Advancement may come in the form of higher earnings, as operators gain experience and build up a steady clientele, or as they become skilled specialists in one or more phases of the work. For those who wish to specialize, advanced courses in hair styling, hair coloring, and other types of work are available in many localities, sometimes offered by public or private schools, and sometimes by manufacturers of beauty preparations or by

other individuals and organizations. Experienced operators may also advance to positions in which they manage large salons or open salons of their own. Others advance to teaching positions in cosmetology schools, or use their knowledge and skills in some different type of employment—working as demonstrators for manufacturers of cosmetics, for example, or as beauty editors for newspapers and magazines, or inspectors for State cosmetology boards.

To be successful, a cosmetologist should keep abreast of changing hair styles and beauty techniques. Ability to establish and maintain friendly relationships with people is also important, as are good grooming, dexterity, a sense of form and artistry, and willingness to follow instructions and patrons' wishes. A prime requisite is a sense of responsibility. An operator's job also calls for physical stamina, since a great deal of standing is normally required.

In a few salons, operators may be required to furnish such implements as brushes, combs, and clips. Usually operators furnish their own uniforms.

### Employment Outlook

During the rest of the 1960's and through the 1970's, job opportunities are expected to be very good for newcomers to this field, as well as for experienced cosmetologists and those who are seeking part-time work. Employment in this occupation is expected to continue to expand very rapidly. Among the factors responsible for this expected employment growth are the population increase and the more frequent use of beauty salons as income levels rise and more women take jobs outside the home.

In addition to new job opportunities created by growth, the number of replacements needed as cosmetologists retire or stop working for other reasons will average nearly 25,000 each year. Still other openings will become available as jobs are

vacated by workers leaving to enter other kinds of employment.

### Earnings and Working Conditions

Many cosmetologists are paid on a straight commission basis. Others receive a salary plus commission and still others, a straight salary. Estimating total earnings is difficult because, in addition to salaries and commissions, most cosmetologists receive tips, and tipping practices vary in different localities. Earnings of cosmetologists also depend on such factors as experience, speed of performance, skill, type and location of the salon, and the ability to satisfy patrons and build up a clientele.

Many beginning operators earn between \$60 and \$80 a week, according to limited information available. A very few top stylists and others in highly specialized jobs may earn up to \$300 or more a week.

Most full-time operators work 40 hours or longer a week. The scheduled hours of full-time operators usually include late afternoon and Saturday work. Many part-time operators are also employed during these busy periods.

In many large salons and in establishments such as department stores and hotels, operators may participate in group life and health insurance and other employee benefit plans sponsored by the employer. Some salons allow their employees annual paid vacations of at least 1 week after a year's service.

The most active union in this occupational field is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. Other organizations in the field are the National Hairdressers and Cosmetologists Association, Inc., which includes both shopowners and operators; The Associated Master Barbers and Beauticians of America, representing salon owners and managers; and the National Beauty Culturists' League, made up of Negro operators, teachers, managers, and salon owners.

**Where To Go for More Information**

State boards of cosmetology can supply information about approved training schools and requirements for licensing.

Additional information about careers in beauty culture, and State li-

censing requirements, can be obtained from:

National Association of Cosmetology Schools, Inc.,  
3839 White Plains Rd., Bronx, N.Y.  
10467.

General information about cosmetology may also be obtained from:

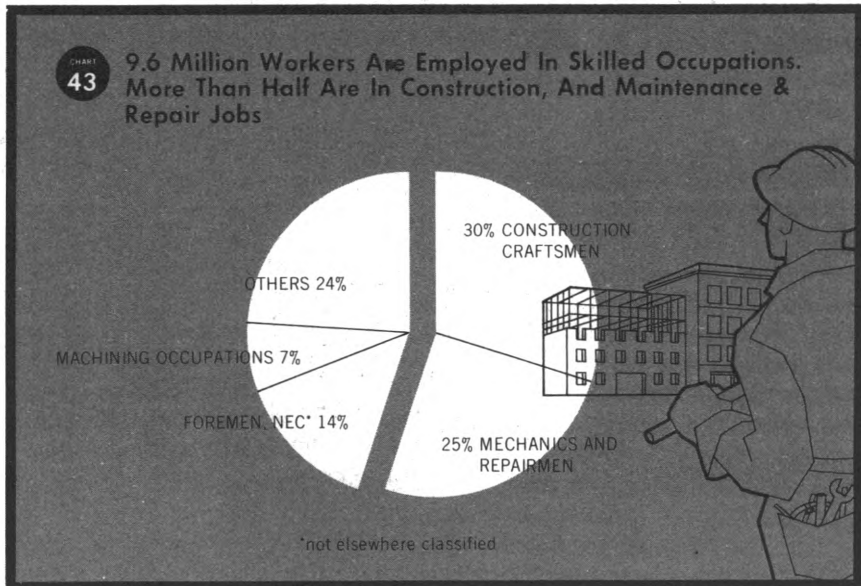
National Hairdressers and Cosmetologists Association,  
175 Fifth Ave., New York, N.Y.  
10010.

Journeyman Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America,  
1141 North Delaware St., Indianapolis, Ind. 46207.



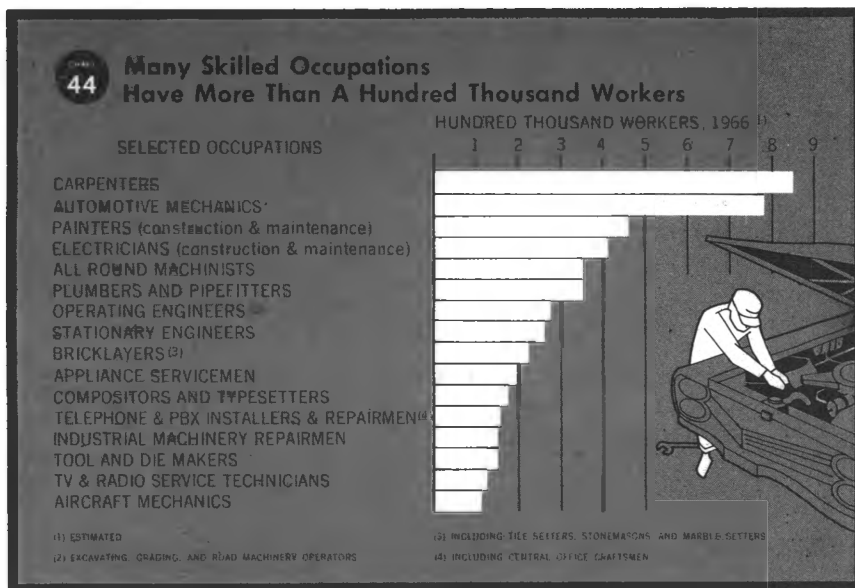
# SKILLED AND OTHER MANUAL OCCUPATIONS

The 27.2 million manual (blue-collar) workers—skilled, semiskilled, and unskilled—employed in 1966 made up more than one-third of all employed workers. They worked in hundreds of different occupations, including such diverse jobs as instrument maker, sewing machine operator, and construction laborer. Men and women in manual occupations perform important functions in our economy. They help transform the ideas of scientists and the plans of engineers into goods and services. They help operate transportation systems, communication facilities, and atomic installations. They build homes, office buildings, and factories. They work in factories where they build, install, control, maintain, and repair the complex equipment needed by our highly mechanized society. They repair automobiles, and television sets, washing machines, and



other household appliances. Manual workers move raw materials, wrap and pack finished products, and load and unload supplies of all kinds.

Young persons with mechanical interests and abilities, or others who like to work with their hands, will find most of their employment opportu-



sions are more detailed statements on selected manual occupations. Many other manual occupations are also described in individual industry statements elsewhere in the *Handbook*.

## Skilled Workers

(Craftsmen, Foremen, and Kindred Workers)

The Nation's economic and military strength depends to a great extent on the initiative and competence of its craftsmen. 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. They repair the equipment used in industry, and the mechanical equipment and appliances used by consumers. They also construct homes, commercial and industrial buildings, and highways.

In 1966, there were 9.6 million skilled workers. More than half of them were employed in two broad occupational groupings—construction craftsmen and mechanics and repairmen. (See chart 43.) Two occupations had more than three-fourths of a million workers each—carpenters and automotive mechanics. About a dozen additional skilled occupations had more than 100,000 workers each. (See chart 44.) However, many skilled occupations, for example, electrotypers, blacksmiths, and paperhangers had fewer than 20,000 workers each.

Although skilled workers are employed in almost every branch of industry, nearly two-thirds are employed in manufacturing and construction. More than four-fifths of all skilled workers are employed by private firms; 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

ities among the hundreds of different occupations in this group.

Technological progress is causing major changes in the occupational composition of the labor force. Rapid advances in the industrial applications of scientific knowledge and invention are making possible greater use of electronic, mechanical, hydraulic, pneumatic, and other devices to feed, control, handle, and adjust the machinery and equipment used in manufacturing. However, the number of skilled and semiskilled workers is expected to continue to increase through the 1970's, despite rapid mechanization and automation of production processes. Concerning skill requirements, it is expected that our increasingly complex technology generally will require higher levels of skill.

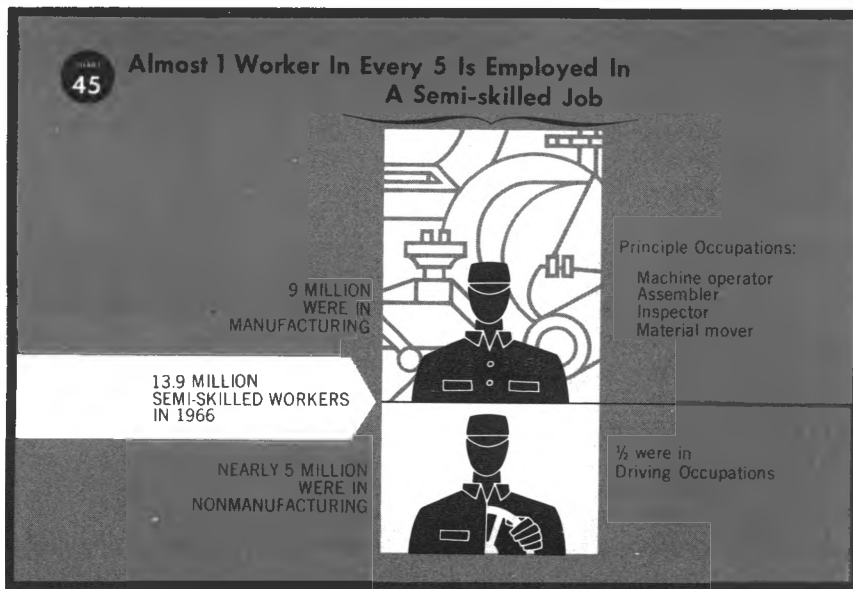
Although manual (blue-collar) workers declined slightly as a proportion of total employment between 1956 and 1966, their number increased by nearly 2 million. Semiskilled workers accounted for slightly more than half of the increase and skilled workers for slightly less than half. Employment of unskilled workers remained relatively constant over the same period.

Through the 1970's, employment of manual workers is expected to increase only about half as fast as total

employment. However, there will be different rates of growth for each of the three major occupational groups which make up the manual worker category. For example, employment of skilled workers is likely to increase at about the same rate as total employment; semiskilled workers will grow at a much slower rate; and no significant change is expected in the number of unskilled workers.

In addition to the large number of job opportunities expected to be available for manual workers because of employment growth, an even larger number is expected to result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Replacement needs due to retirements and deaths alone should provide about 600,000 job openings annually. For skilled workers, replacement needs are expected to offer about the same number of job opportunities as employment growth. For semiskilled workers, replacement needs are expected to offer more than twice as many job opportunities as employment growth. For unskilled workers, virtually all the job opportunities will be due to replacement needs.

The skilled, semiskilled, and unskilled occupation groups are discussed separately in the following sections. Following these general discus-



expected, the skilled work force is concentrated in the highly industrialized States, such as New York, California, Pennsylvania, Illinois, and Ohio. Job opportunities for skilled workers, however, are found in every State. A very small proportion (less than 3 percent) of skilled workers are women.

#### Training, Other Qualifications, and Advancement

Skilled workers must have a thorough knowledge of the processes involved in their work. They exercise considerable independent judgment and may be responsible for valuable equipment or products. Consequently, they need considerable training to qualify for their jobs. A large proportion of skilled workers learn their trades through informal on-the-job training and experience. Many others learn their trades through apprenticeship or other formal training programs. Large numbers of young men also acquire skills in the armed services. For others, vocational school training plays an important role.

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 familiarize the apprentice with the materials, tools, and principles of the trade. The apprenticeship program provides the worker with a balanced knowledge of his trade. The formal apprenticeship agreement specifies the number of hours of training the apprentice is to receive in the various aspects of the trade. Most apprenticeship programs last 4 years; they may range 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 that enable him to adjust more easily to changing job requirements, and to work in a wide range of jobs. The completion of an apprenticeship gives the worker a recognized status that is an advantage in finding and holding jobs. It may also increase his opportunities for promotion to a supervisory job.

Many companies have other kinds of training programs that also provide systematic on-the-job training. Frequently, such programs include supplementary classroom instruction.

Many young persons move from one semiskilled job to another and,

over a period of years, acquire knowledge and skills sufficient to become skilled workers. Others begin learning a skilled trade in vocational, trade, or technical schools. A small proportion of these students move directly into jobs in their trade and, after acquiring experience, qualify as skilled workers. Other young persons, who are already employed in semiskilled or unskilled jobs, move into skilled occupations through vocational training related to their work, such as correspondence courses, manufacturers' training programs, and night school courses.

Large numbers of young men in the Armed Forces acquire skills that enable them to qualify, with some additional training, for skilled jobs in civilian life, such as automobile mechanic, electronic technician, aircraft mechanic, electrician, or office machine repairman.

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.

Young people who do not expect to go to college should consider the definite advantages that the skilled trades offer, compared with semiskilled and unskilled occupations. Skilled workers have higher earnings, more job security, better chances for promotions, and more opportunities to open their own business than most of the workers with lesser skills. Among the 11 occupational groups that make up our labor force, only men in the professional, managerial, and salesworker groups had higher earnings than the average \$6,824 a year earned by skilled men in 1965.

#### Employment Trends and Outlook

Employment in skilled occupations grew from about 8.7 million workers in 1956 to 9.6 million in 1966. Continued growth in the number of skilled jobs is expected in the years ahead. Job opportunities will

also result from the need to replace skilled workers who transfer to other fields of work, are promoted, retire, or die. More than 200,000 skilled workers are expected to be needed each year to replace those who retire or die.

Employment in skilled occupations is expected to rise moderately through the 1970's because of industrial growth and technological advances that increase the need for skilled workers. As in the past, rates of employment growth will differ among the skilled occupational groups. Employment of mechanics and repairmen, for example, should continue to grow more rapidly than the skilled work force as a whole. The numbers of skilled workers in the building trades and the major skilled machining occupations are expected to increase at more moderate rates. On the other hand, employment in the printing trades is expected to show little or no change.

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 than applicants without this training.

## Semiskilled Workers

### (Operatives)

Semiskilled workers make up the largest occupation group in the Nation's labor force. About 13.9 million workers—almost 1 in every 5—were employed in semiskilled jobs in 1966. Of the 9 million semiskilled workers employed in manufacturing industries (see chart 45), large numbers were engaged in making clothing, automobiles, automobile parts, food, textiles, machinery, and electrical and electronic equipment. The broad

field of semiskilled jobs will provide hundreds of thousands of employment opportunities for young people looking for jobs in the years ahead.

Truckdrivers are the largest group of semiskilled workers. Millions of other semiskilled workers operate power driven machines in factories. Many use sewing machines to join fabrics for clothing, awnings, and other items. Others operate machines to stamp out metal parts; still others use machine tools, such as engine lathes and milling machines, to shape metal to precise sizes. A considerable number of these workers operate materials moving equipment, such as powered forklift trucks, to move raw materials and manufactured products from place to place in factories.

Large numbers of semiskilled workers are employed as assemblers and inspectors. Assemblers install components and subassemblies into end products such as radios and television sets. Inspectors examine and test products to find out whether their quality is satisfactory. Many semiskilled workers in factories are employed as helpers or assistants to more skilled workers. For example, stationary firemen help skilled stationary engineers operate and maintain steam boilers.

In 1966, about 4.1 million women accounted for almost 30 percent of all semiskilled workers. Semiskilled jobs, such as sewing machine operators, packers and wrappers, assemblers, and laundry and drycleaning operators, were by far the largest source of employment for women in manufacturing industries. The number of women operatives employed in the different manufacturing industries varies considerably. Women accounted for more than 8 out of 10 operatives in the apparel industry. Other manufacturing industries with large numbers of women operatives were textiles and food. On the other hand, plants that produce iron and steel and petroleum products employed relatively few women.

In general, operatives work with their hands. Many of these workers use a variety of handtools such as screwdrivers, pliers, files, soldering irons, measuring devices, and cutting tools. Many of these workers also make elementary adjustments and do minor maintenance work on the machines they use. Some are required to keep simple records of their work.

### Training, Other Qualifications, and Advancement

Semiskilled workers ordinarily receive only brief on-the-job training. Usually they are told exactly what to do and how to do it, and their work is supervised closely. They often repeat the same motions or the same jobs throughout the working day.

Semiskilled workers do not need to invest many years in learning their jobs. The simplest repetitive and routine semiskilled jobs can be learned in a day and mastered in a few weeks. Even those jobs that require a higher degree of skill, such as truckdriver, can be learned in a few months. At the same time, adaptability—the ability to learn new jobs quickly, including the operation of new machines—is an important qualification for semiskilled workers.

New employees starting out in semiskilled jobs are not expected to be highly proficient. After a short training period, however, they must work at a standard, fast, and steady pace. Frequently, good eyesight and good coordination are required.

Semiskilled jobs often pay well. Some semiskilled workers who are paid on an incentive basis are among the highest paid workers in manufacturing. However, the average annual earnings of semiskilled men in 1965 were about \$1,000 less than those of skilled men. Also, semiskilled workers are more likely to lose their jobs during a business recession, and to remain unemployed longer than skilled or white-collar employees.

### Employment Outlook

The employment of semiskilled workers is expected to increase slowly through the 1970's; however, it is expected that this group will decrease somewhat as a proportion of the working population. More than two-thirds of all job opportunities for semiskilled workers are expected to result from the need to replace workers who are promoted, transfer out of semiskilled jobs, retire, or die. More than 300,000 semiskilled workers will be needed each year to replace those who die or retire. Transfer rates for semiskilled workers are high because a fairly large proportion of them are young workers who tend to change jobs frequently, and women workers who leave jobs to marry, raise families, or move to other areas when their husbands change jobs.

The continued growth in the use of commercial motor vehicles will result in some increase in employment opportunities for truck and bus drivers. Continuing substitution of power equipment for unskilled manual labor in lifting, hauling, digging, and similar heavy physical work will create other employment openings for semiskilled workers, such as power equipment operators. Opportunities for employment in manufacturing will be limited by increasing automation of production processes. There are many industrial processes, however, to which automation is not likely to be applied in the next 10 years, and many industries in which the impact of automation will be limited.

Young men and women who have no training beyond high school will continue to find a major area of job

opportunities in factory operative and other semiskilled jobs. The most rapid gains in the Nation's employment, however, will be in professional, technical and other white-collar occupations and in skilled occupations. If possible, young people with ability should obtain the additional training and education that these occupations require. Semiskilled workers, however, even those who did not complete high school, are not cut off permanently from advancement if they take advantage of the many educational opportunities available in their communities. They may take courses in evening schools or enter apprentice training programs and eventually qualify for better jobs.

## Unskilled Workers

### (Laborers)

Unskilled laborers work in manual occupations that generally require no special training. Frequently, these jobs involve handling and moving materials, for example, loading or unloading, digging, hauling, hoisting, wrapping, and mixing. Some of these jobs involve heavy physical work. Unskilled laborers are employed mainly in manufacturing establishments, on construction work, in wholesale and retail trade, and in transportation jobs.

Although some of these jobs pay well, particularly in construction work, the average annual earnings of unskilled men in 1965 were about

\$1,350 less than those of semiskilled men. Moreover, unskilled workers are usually the first to lose their jobs during a business recession and have the highest unemployment rate of all the major occupational groups.

The longrun decline in employment of unskilled workers has occurred largely because mechanized equipment has replaced manual labor. In 1966, employment of unskilled laborers was approximately 3.7 million—5 percent of the Nation's work force. In the future, total employment in this occupational group is expected to show little change. Nevertheless, there will be thousands of opportunities for new workers to get jobs as unskilled laborers because of the need to replace workers who transfer to other fields of work, retire, or die. Deaths and retirements alone will result in almost 70,000 job openings each year.

The replacement of unskilled workers by machinery will continue through the 1970's. Power-driven equipment, such as forklift trucks, derricks, cranes, hoists, and conveyor belts will take over more and more materials-handling work in factories, freight terminals, and warehouses. Other power-driven machines will do excavating, ditchdigging, and similar work. Integrated systems of processing and materials-handling equipment, a more advanced step in automation, will be installed in an increasing number of plants in the years ahead. Industrial expansion, however, is expected to create a need for unskilled laborers which will about offset the jobs lost to labor-saving mechanical equipment.

craftsmen. By contrast, only a few thousand workers were employed in each of several trades, such as marble setter, terrazzo worker, glazier, and stonemason.

### What Are the Building Trades?

Building trades craftsmen are employed mainly in the construction, maintenance, repair, and alteration of homes and other types of buildings, highways, airports, and other structures, including substantial work involved in the Nation's missile and space programs. The wide range of materials and skills used in construction work has resulted in specialization of various work operations. Thus, building trades workers who use essentially the same materials or skills have tended to become identified with distinct trades. For example, bricklayers and stonemasons both 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 (craftsmen) 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:

Occupations mainly concerned with structural work: Carpenter, operating engineer (construction machinery operator), bricklayer, structural-iron worker, ornamental-iron worker, cement mason, reinforcing-iron worker (rodman), rigger and machine mover, stonemason, and boilermaker.

Occupations mainly concerned with finishing work: Lather, plasterer, marble setter, tile setter, terrazzo worker, painter, paperhanger, glazier, roofer, floor covering installer, and asbestos worker.

Occupations mainly concerned with mechanical work: Plumber, pipefitter, construction electrician, sheet-metal worker, elevator constructor, and millwright.

Most of the building 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 types of work done in the various trades.

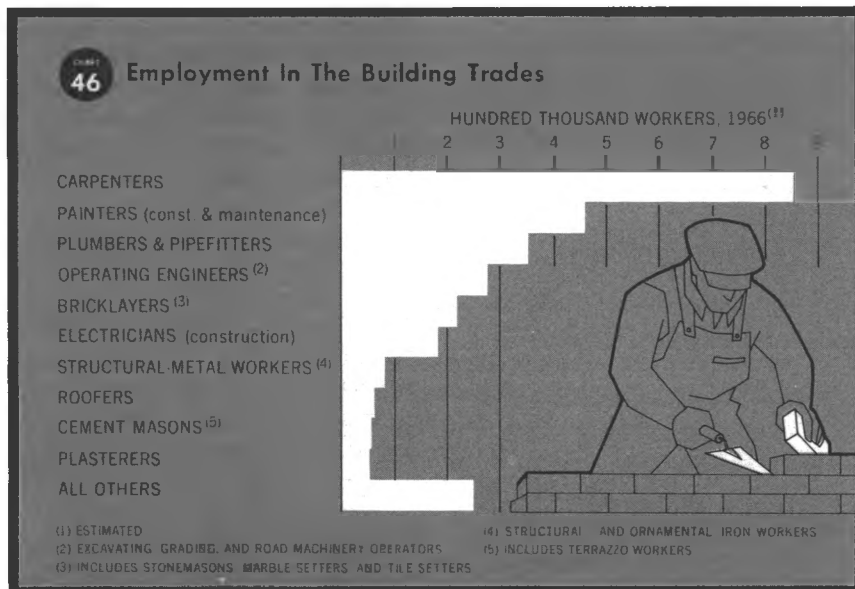
Also, they are not statements or recommendations concerning the work jurisdiction of these trades and are inappropriate for use in jurisdictional negotiations or the settlement of jurisdictional questions.

(Detailed descriptions of the nature of the work, training, employment outlook, and other information concerning boilermakers and millwrights appear elsewhere in the *Handbook*.)

## BUILDING TRADES

Building trades craftsmen make up the largest group of skilled workers in the Nation's labor force. Altogether, there were more than 2¾ million such craftsmen employed in 1966—about 3 of every 10 skilled workers.

The more than two dozen skilled building trades vary greatly in size. Several major trades—carpenter, painter, plumber, pipefitter, bricklayer, operating engineer (construction machinery operator), and construction electrician—each had more than a hundred thousand workers. (See chart 46.) Carpenters alone numbered slightly more than 850,000—nearly one-third of all building



### Where Building Trades Workers Are Employed

Building trades workers are employed mainly by contractors in the contract construction industry. Many others are employed in industries other than construction, mainly to do maintenance work. Some work directly for business firms or government agencies that have their own construction work force, and 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, tunnels, 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 may 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 done almost always 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 operate within a limited geographical

area. The great majority are small—generally employing fewer than 10 workers. Some firms employ several thousand workers each.

Thousands of building trades workers are employed in factories, stores, mines, hotels, and most other types of large business establishments. For example, plumbers and pipefitters are employed by firms to maintain, repair, and install piping systems. In addition, large firms frequently employ crews of building trades workers to construct houses, office buildings, and other new structures. Government agencies also employ many construction craftsmen to build, maintain, and repair highway, water, and sanitation systems.

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.

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.

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. In other trades, craftsmen may work in the

central shop of the contractor or in fabrication shops at the job site.

Employment of these workers is distributed geographically 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, Illinois, Pennsylvania, Ohio, and Texas.

### Training, Other Qualifications, and Advancement

Most training authorities, including national joint labor-management apprenticeship committees established for most of the building trades, recommend formal apprentice training as the best way to acquire the all-around proficiency of craftsmen in the building trades. Apprenticeship is a prescribed period of on-the-job training, supplemented by related classroom instruction, which is designed to develop skill by making the apprentice familiar with the materials, tools, and principles of his trade. This type of training provides the apprentice with a balanced knowledge of his field of work and enables him to perform its operations competently. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Many building trades workers have acquired the skills of their trades informally, by working for many years as laborers and helpers, observing or being taught by experienced craftsmen. Some building trades craftsmen have acquired their skills, or part of their skills, by attending vocational or trade schools, or by taking correspondence school courses.

Apprentices in the building trades generally are required to be between the ages of 18 and 25, and in good physical condition. (The maximum age limit may be waived for veterans or others with experience or special qualifications.) A high school educa-

tion, or its equivalent, with courses in mathematics and the sciences, is desirable and, in a few trades, actually required. 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 alignment of materials.

The formal registered apprenticeship agreement generally stipulates a training period of 2 to 5 years of relatively continuous employment and training, in addition to a minimum of 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 pipe-work, work on 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, sometimes, through correspondence courses.

The formal registered apprenticeship agreements also stipulate the length of time the apprentice is to be 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 local union. 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. Whenever 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 an

apprenticeship program coordinator.

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 this type of apprenticeship program, but such a program 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 early 1967, about 120,000 men were registered in apprentice training programs in the construction trades and perhaps more than 20,000 other apprentices were in unregistered programs. In the years ahead, opportunities for many young men to receive apprentice training will be available in all parts of the country. In addition, thousands of other workers will be able to learn 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 slightly more than one-half of the number of registered apprentices in training for selected building trades in early 1967: California, New York, Michigan, Ohio, Texas, Pennsylvania, Illinois, and New Jersey.

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 such licenses, they must pass an examination, showing a well-rounded knowledge of the job and of State and local regulations.

Building trades craftsmen may advance in a number of ways. For example, a journeyman may become a foreman in charge of a crew. In most localities, small jobs are run by "working foremen" who work at the trade along with members of their crews. On very large jobs, the foremen do supervisory work only. A craftsman can also become an estimator for a contractor. In this job, he estimates material requirements and labor costs to enable the contractor to bid on the work of a particular construction project. Some craftsmen advance to jobs as superintendents on large projects. Others 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.

It is easier to start a small contract construction business than it is to start a small business in many other industries. 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. However, the contract construction field is highly competitive, and the rate of business failure is especially high among small contractors. To be successful, the proprietor of a small contracting firm must have the ability to plan work, to foresee needs and problems, to direct others, and 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. Sound journeyman knowledge increases chances for success. Some States or municipalities require contractors to be licensed.

### Employment Outlook

Employment in the building trades is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. (If the high levels of economic activity are not achieved, employment in the building trades will increase at a slower rate than that projected.) In addition to employment growth, tens of thousands of job openings will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will provide about 70,000 job openings in the building trades each year through the 1970's.

The moderate increase in total employment in the building trades (7 of every 10 of whom are employed in the construction industry) is expected to result primarily from the rapid rise in the level of construction activity. The factors that will stimulate construction activity include anticipated large increases in population and in the number of households; a continuing shift of families from the cities to the suburbs; increases in government expenditures for highways and schools; a rise in expenditures for new industrial plant capacity; and higher levels of personal and corporate income. In addition, there will be a growing demand for alteration and modernization work on existing structures, as well as maintenance and repair work on the expanding highway system, and on the increasing numbers of dams, bridges, and similar projects.

Employment of building trades workers outside the construction industry is expected to expand as a result of the anticipated high levels of economic activity, which will stimulate the construction of a growing number of commercial and industrial buildings and, therefore, increase maintenance and repair requirements.

The increase in building trades employment will not be as great as the total expansion in construction activity, because continued technological developments in construction methods, tools and equipment, and materials will permit increasing output per construction worker. An important development in construction methods is the increasing use of prefabricated components, which are installed as complete units at the job site, for almost all types of construction projects. For example, preassembled outside walls and partitions can be lifted into place in one operation, and electric circuit boxes and switchboards are being prewired at the factory instead of being wired by the electrician at the job site. An important extension of prefabrication is "module building" in which units, including complete rooms or buildings, are available in standard sizes. Furthermore, standardization of components will contribute to their greater use.

Technological advances in construction tools and equipment will also increase the efficiency of building trades workers. Power handtools, such as shock resistant, cordless, electric-powered tools, are improving worker efficiency. Items formerly unloaded and moved to the construction site by hand, such as concrete and brick, are now being moved by fork-lift trucks, motorized wheelbarrows, and conveyor belts. The size, speed, durability, and mobility of large construction machines, including cranes, bulldozers, and scrapers, have increased considerably. Many of these machines can do many times more work than even the largest machines of a few years ago, but still require only one operator. New types of machines that reduce labor requirements also are being developed, including concrete paving machines that perform the work formerly done by four separate machines.

New and improved construction materials also are expected to limit

employment growth among building trades workers. For example, lightweight and durable plastics are being used for a growing variety of components, including partitions, wall panels, siding, insulation, and roofing. Other new and improved products are adhesives that eliminate the need for conventional fasteners, nails that have improved holding power, paints that last twice as long as paints in common use, and wood products that come from the factory pre-painted with the prime coat and even the final coat.

The rates of employment growth will differ among the various building trades. Employment growth is expected to be most rapid for glaziers; structural-metal workers; excavating, grading and road machinery operators; and cement masons. Among the trades that will have a slower growth rate are stonemasons, painters, and carpenters.

(A more complete statement covering training, other qualifications, advancement, and employment opportunities in the major building trades is given in the discussions of individual occupations later in this chapter.)

### Earnings and Working Conditions

Hourly wage rates paid to building trades craftsmen are among the highest paid to skilled workers. However, because construction work is seasonal and time is lost for other reasons, average annual earnings of building trades craftsmen are not as high as the hourly rates of pay would indicate.

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. Union minimum hourly rates for journeymen and for helpers and laborers in selected building trades in 68 large cities, as of July 1, 1966, averaged as follows:

	<i>Union minimum average hourly rate</i>
All building trades-----	\$4. 59
Journeymen -----	4. 83
Asbestos workers-----	4. 88
Bricklayers -----	5. 04
Carpenters -----	4. 74
Cement masons (finishers)----	4. 57
Electricians (inside wiremen)---	4. 98
Elevator constructors-----	5. 05
Glaziers -----	4. 47
Lathers -----	4. 80
Marble setters-----	4. 85
Terrazzo workers-----	5. 10
Tile setters-----	4. 79
Painters -----	4. 46
Paperhangers -----	4. 37
Pipefitters -----	5. 05
Plasterers -----	4. 89
Plumbers -----	5. 08
Roofers, composition-----	4. 54
Roofers, slate and tile-----	4. 37
Sheet-metal workers-----	4. 89
Stonemasons -----	4. 89
Structural-iron workers-----	4. 97
Rodmen -----	4. 83
Helpers and laborers-----	3. 67
Bricklayers' tenders-----	3. 93
Building laborers-----	3. 56
Composition roofers' helpers---	2. 90
Elevator constructors' helpers---	3. 64
Marble setters' helpers-----	3. 97
Terrazzo workers' helpers-----	4. 14
Tile setters' helpers-----	3. 96
Plasterers' laborers-----	3. 89
Plumbers' laborers-----	3. 82

Union rates for these occupations are negotiated between trade unions and employers. They do not include overtime, bonuses, or payments for special qualifications or for other reasons.

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, heat is commonly provided. Many persons prefer construction work to other skilled occupations, because they can work outdoors.

Construction work is generally more dangerous than work in manufacturing, but the risk of injury is lessened considerably when proper work practices are followed.

Forty hours was the standard work-week for a vast majority of union building trades workers in 1966. Time and one-half was generally paid for hours worked beyond the standard workday of 8 hours. Time and one-half or double-time rates were usually paid for work on Saturdays and Sundays or on holidays.

A substantial proportion of organized building trades workers are included in health, insurance, and pension programs negotiated between unions and employers, and financed entirely by employer contributions.

There are several reasons why young men may wish to 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. As previously noted, building trades craftsmen with business ability have greater opportunities to establish their own businesses than workers in many other skilled occupations. In addition, there will be job opportunities for workers in the major building trades in nonconstruction industries, mainly in maintenance and repair activities. This work is generally less seasonal than contract construction work.

A principal disadvantage of work in the building trades is the employment fluctuations that result from changes in general business conditions. 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. Worktime is lost as a result of bad weather and other interruptions.

A large proportion of 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.

**Where To Go for More Information**

Information about opportunities for apprenticeship or other types of construction employment in a particular locality should be obtained from individual construction firms, employer associations, locals of the building trades unions, the nearest office of the State apprenticeship agency, or the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. Many apprenticeship programs are supervised by local joint union-management 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 addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

For more information on jobs in the building trades, inquiries should be directed to the organizations listed below:

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department, 815 16th St. NW., Washington, D.C. 20006.

Associated General Contractors of America, Inc., 1957 E. St. NW., Washington, D.C. 20006.

National Association of Home Builders, 1625 L St. NW., Washington, D.C. 20036.

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.

**ASBESTOS AND INSULATING WORKERS**

(D.O.T. 863.381, .781, and .884)

**Nature of Work**

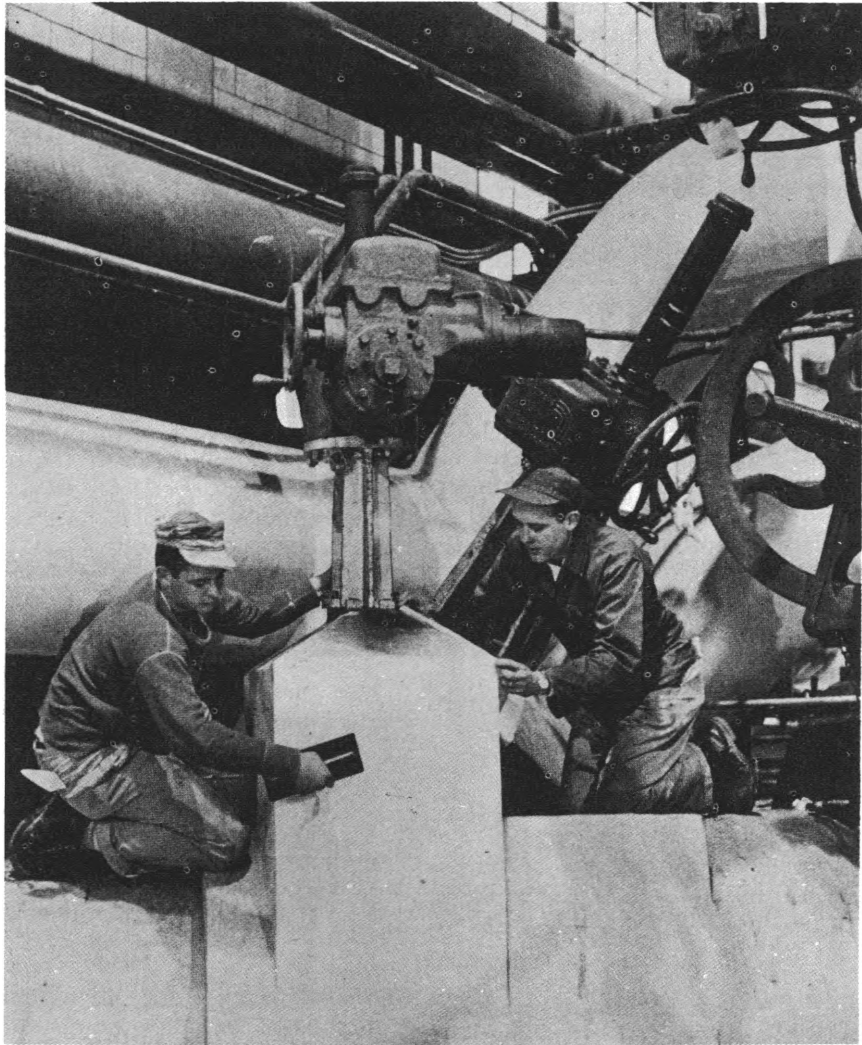
The principal work of asbestos and insulating workers is to cover pipes, boilers, and other related equipment with insulating materials, such as cork, felt, asbestos, fiberglass, polyurethane, and magnesia. These materials are installed by pasting, wiring, taping, stud-welding, spraying, or other methods. Asbestos and insulating workers use handtools, such as trowels, brushes, scissors, hammers,

saws, pliers, and stud-welding guns. Powersaws, as well as handtools, are used to cut insulating materials.

The insulating materials which these workers install serve many purposes. For example, the insulation of pipes, ducts, tanks, vats, boilers, and furnaces retains heat and thus saves fuel. Insulation of piping in refrigeration systems prevents heat absorption.

**Where Employed**

Most asbestos workers are employed by insulation contractors in new industrial and commercial construction. A substantial number are employed in the alteration and main-



Asbestos workers apply insulation material to refrigeration units.

tenance of insulated pipework in chemical plants, petroleum refineries, atomic energy installations, and other industrial establishments which have extensive steam installations for power and heating. Some large establishments which have cold storage facilities also employ asbestos workers for maintenance work.

### Training, Other Qualifications, and Advancement

Most asbestos workers learn their trade through a 4-year "improvership" program similar in many respects to apprenticeship programs 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 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's rate is reached during the final stage of the program. At the end of the 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 of asbestos and insulating workers—estimated at about 22,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. Employment

growth will result mainly from the anticipated large rise in the volume of construction activity, particularly of commercial and industrial building. (See discussion, p. 321.) The increasing use of industrial pipe in numerous manufacturing processes and for air-conditioning and refrigeration installations will expand the need for asbestos workers in installation and maintenance work. In addition to the job openings resulting from the growth of the trade, other opportunities will arise from the replacement of workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in nearly 300 jobs openings annually through the 1970's.

### Earnings

Union minimum hourly wage rates for asbestos workers averaged \$4.88, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities, the minimum hourly rates for asbestos workers ranged from \$3.70 in Charlotte, N.C., to \$5.90 in New York City.

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers.

### Where To Go for More Information

For further information regarding asbestos workers' improvership programs or other work opportunities in this trade, inquiries should be directed to local asbestos contractors or to a local of the International Association of Heat and Frost Insulators and Asbestos Workers. In addition, the local office of the State employment service may be a source of information about work and training opportunities, including training programs operated under the Manpower Development and Training Act.

General information about the work of asbestos and insulating workers may be obtained from:

Insulation Distributor-Contractors  
National Association, Inc.,  
1425 Chestnut St., Philadelphia, Pa.  
19102.

International Association of Heat and  
Frost Insulators and Asbestos  
Workers,  
1300 Connecticut Ave. NW., Wash-  
ington, D.C. 20036.

### BRICKLAYERS

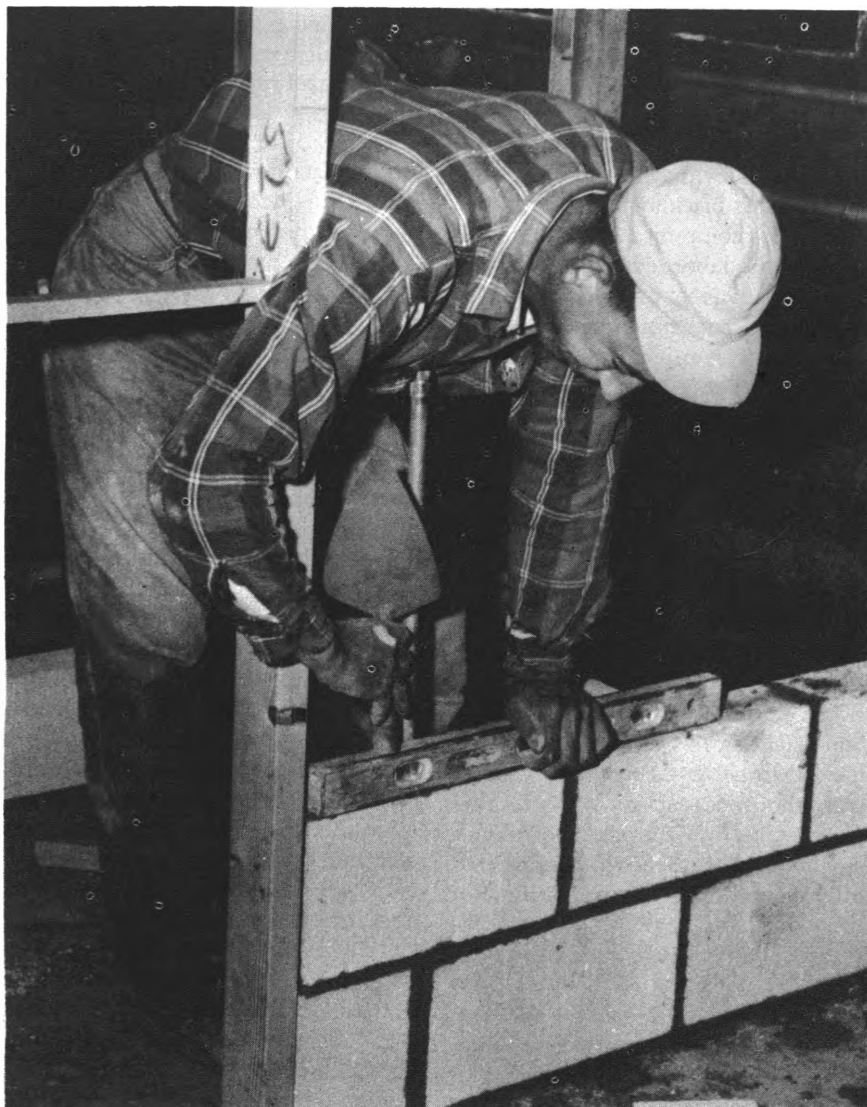
(D.O.T. 861.131, .381, .781, and .884)

### Nature of Work

Bricklayers (or brickmasons) are craftsmen who construct walls, partitions, fireplaces, chimneys, and other structures from brick. They also work with various other masonry materials, such as concrete or cinder block; precast panels made of concrete, stone, or marble; porcelain glazed tile; structural tile; and terracotta (a hard baked clay material used for ornamental purposes). They also install the brick linings of industrial kilns and furnaces.

When building a brick wall, corners are usually constructed at each end of the building or wall using plumb lines and a mason's level. The bricklayer is then able to stretch a horizontal line (gage or course line) from corner to corner as a guide for each course of brick. The line is raised when the course is completed. On longer walls, a brick is often set at fixed points along the wall, plumbed for accuracy, and the course line is triggered to this brick. The line trigger overcomes sag in the course line, lessens line movement from the wind and from other bricklayers working on the wall, and overall, helps to insure the accuracy of the finished brickwork.

In laying brick, a bricklayer first spreads a layer or "bed" of mortar. He then applies a full cross-joint of mortar to one end of the brick to be laid or to the end of the last brick



laid. In a single motion, he places the brick on the bed joint while positioning the cross-joint between the bricks to the desired width. A tap or two with his trowel positions the brick to the course line. He then cuts off the excess mortar with his trowel and is then ready to lay the next brick. Once the course is completed (or sometimes sooner), the mortar joints between the brick are struck (jointed) with special finishing tools to achieve a neat and uniform appearance.

If two or more thicknesses of brick are being laid, the bricklayer lays a "bond" or "header" course at regular intervals (usually every sixth or seventh course); that is, he arranges a course of bricks cross wise or in

another bond pattern in order to tie the interior and exterior walls into a single unit. Whether the bricklayer works with brick, block, or other masonry material, the work is essentially the same.

Bricklaying requires careful, accurate work combined with planning and proper layout so that the structure will have a uniform appearance and the brickwork will line up with windows, doors, and other openings in an acceptable manner. Craftsmen in this trade mainly use handtools, including trowels, brick hammers, levels, jointers, brick cutting chisels, and rules. Powersaws are often used for cutting and fitting masonry materials; however, a bricklayer will

usually cut brick with his trowel, brick hammer, or brick chisel. Journeymen bricklayers are usually assisted by hod carriers or helpers who stock scaffolds with mortar, bricks, and blocks; mix the 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 to build manholes and catch basins. 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. They also do a substantial amount of maintenance and repair work.

Bricklayers also work for such industrial establishments as factories making glass or steel, where furnaces and kilns require special fire brick and refractory brick linings. For example, in a steel manufacturing plant, the bricklayer lines converters, cupolas, and ladles which hold molten metal. Bricklayers must have additional training to do refractory brick work.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Bricklaying Apprenticeship and Training Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn this trade. Many workers in this trade have acquired bricklaying skills informally, by working for many years as helpers or hod carriers, observing or being taught by experienced bricklayers. Many of these persons have gained additional knowledge of their trade by taking trade school courses.

Apprenticeship applicants are generally required to be between the ages of 17 and 24, but this requirement

may be waived for veterans. A high school education or its equivalent is desirable.

The apprenticeship program generally consists of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. In a typical 3-year bricklayer training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; lay, bond, and tie brickwork; build footings and foundations; do exterior brickwork such as straight wall work, steps, and arches; build columns, piers, and corners; plan and build chimneys, fireplaces, and hearths; lay stone; point brick and stone; clean stone, brick, and tile using acid solutions, and by sandblasting; cut, set, and point concrete and cinder blocks, artificial stone, and glass blocks; and fireproof and waterproof structures. The apprentice receives related classroom instruction in blueprint reading, layout work, measurement and sketches, and welding. In fact, some apprenticeship programs conduct actual welding instructions that qualify trainees as bricklayer-welder upon completion of their training. In addition, the apprentice trainee learns the relationship between bricklaying and other building trades.

In some areas, formal apprentice training for bricklayers includes brief preliminary instruction at a vocational school or some other type of prejob instruction. This training is designed to give the apprentice a basic knowledge in the handling of tools and materials to prepare him for the start of his on-the-job training.

Hourly wage rates for bricklayer apprentices generally 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.

A bricklayer must have an eye for straight lines and proportions. Good physical condition and manual dexterity are important assets. Since the

other building craftsmen must usually fit their work to his, he should know how the parts of a structure fit together.

Bricklayers may advance to jobs as foremen. They may also become estimators for bricklaying contractors. Estimators compute material requirements and labor costs. Some journeymen advance to the position of bricklaying superintendent on large construction projects, while others may start their own bricklaying contracting business.

### Employment Outlook

Employment of bricklayers—estimated at about 175,000 in early 1967—is expected to rise moderately during the rest of this decade and through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, thousands of job opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in about 2,800 job openings annually through the 1970's.

Much of the expected growth in this trade will result from the anticipated large increase in construction activity. (See discussion, p. 321.) The demand for bricklayers will also be favorably affected by such factors as the increasing use of structural clay tile for fire-resistant partitions; glass blocks for exterior walls; and ornamental brickwork for structures, such as exterior screenwalls and lobbies and foyers. In addition, the use of brick masonry load-bearing walls is growing, particularly in apartment buildings.

These favorable developments will be offset to some extent by other construction techniques that reduce the amount of brickwork per structure. For example, the use of steel framework and reinforced concrete in structures permits the elimination of load-bearing exterior brick walls. Also, the

use of metal, glass, and precast concrete wall panels in buildings results in less masonry work. Other recent developments that have increased the efficiency of bricklayers include high-strength mortars that can be applied with caulking guns or compressor-powered extruders.

### Earnings and Working Conditions

Hourly wage rates for bricklayers rank among the highest in the building trades. Union minimum hourly wage rates for bricklayers, as of July 1, 1966, averaged \$5.04, compared with an average of \$4.83 for all journeymen in the building trades, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for bricklayers ranged from \$4 in Richmond, Va., to \$5.70 in New York City. Although these hourly rates indicate high annual incomes for bricklayers, time lost because of inclement weather and occasional periods of unemployment between jobs make average annual earnings less than hourly rates of pay imply.

The work of the bricklayer is active and sometimes strenuous, like the work in other building trades. It involves stooping to pick up materials, moderately heavy lifting, and prolonged standing. Most of the work is done outdoors.

A large proportion of bricklayers are members of the Bricklayers, Masons and Plasterers' International Union of America.

### Where To Go for More Information

For further information regarding bricklaying apprenticeships or other work opportunities in the trade, inquiries should be directed to local bricklaying contractors; a local of the Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship

agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide services such as screening applicants and giving aptitude tests.

General information about the work of bricklayers may be obtained from:

Associated General Contractors of America, Inc.,  
1957 E St. NW., Washington, D.C.  
20006.

Bricklayers, Masons and Plasterers' International Union of America,  
815 15th St. NW., Washington, D.C.  
20005.

Structural Clay Products Institute,  
1520 18th St. NW., Washington, D.C.  
20036.

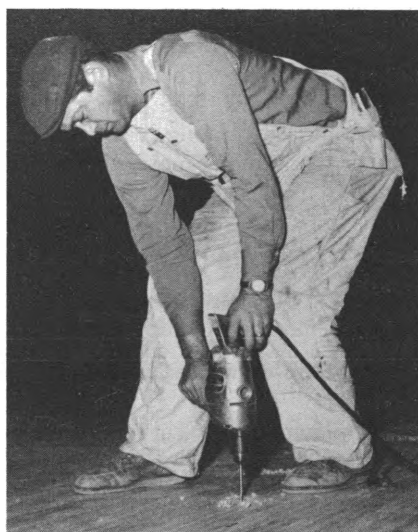
## CARPENTERS

(D.O.T. 860.281 through .781)

### Nature of Work

Carpenters, the largest group of building trades workers, are employed in almost every type of construction activity. They erect the wood framework in buildings, including subflooring, sheathing, partitions, floor joists, studding, and rafters. When the building is ready for trimming, they install molding, wood paneling, cabinets, window sash, doorframes, doors, and hardware, as well as build stairs and lay floors. Carpenters, when doing finish work, must take proper care with the appearance as well as the structural accuracy of the work.

Carpenters also install heavy timbers used in constructing docks, railroad trestles, and similar installations. They build the forms needed to pour concrete decks, columns, piers, and



retaining walls; these component parts are used in the construction of bridges, buildings, and other structures. They also erect scaffolding and temporary buildings on the construction site. Carpenters may also install linoleum, asphalt, tile, and similar soft-floor coverings.

As part of their job, carpenters also saw, fit, and assemble plywood, wallboard, and other materials. They use nails, bolts, wood screws, or glue to fasten materials. Carpenters use handtools such as hammers, saws, chisels, and planes, and power tools such as portable power saws, drills, and rivet guns.

Because of the wide scope of the work performed in the trade, some carpenters tend to specialize in a particular type of carpentry work. For example, some carpenters specialize in installing acoustic panels on ceilings and walls; others specialize in the installation of millwork and finish hardware (trimming), 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 do the work of other craftsmen, particularly painting, glazing, or roofing. Carpenters generally stay in a particular field of construction, such as home, bridge, or highway construction, or in industrial maintenance.

### Where Employed

Most carpenters work in the construction industry and are employed mainly by contractors and homebuilders at the construction site. Carpenters are mostly employed in new construction. A large number, however, are employed on alteration or modernization work. Some carpenters alternate between wage employment for contractors and self-employment on small jobs. Some work for government agencies or nonconstruction firms which employ a separate work force for their own construction work. A large number of carpenters do maintenance work in factories, hotels, office buildings, and other large establishments. Others are employed in shipbuilding, in mining, and in the production of many kinds of display materials.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Carpentry Apprenticeship and Training Committee recommend the completion of a 4-year apprenticeship program as the best way to learn carpentry. A substantial number of workers in this trade, however, have acquired some carpentry skills informally, for example, by working around a farm. Many of these men have also gained some of the knowledge of the trade by taking correspondence or trade school courses.

Apprenticeship applicants are generally required to be from 17 through 27 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 above the ground are important assets. Aptitudes which the apprentice should have include manual dexterity and the ability to solve arithmetic problems quickly and accurately.

The apprenticeship program usually consists of 8,000 hours (4 years) of on-the-job training, in addition to

a minimum of 144 hours of related classroom instruction each year. During the apprenticeship period, the apprentice learns elementary structural design and becomes familiar with the common systems of frame and concrete form construction, and to use, care for, and handle safely the tools, machines, equipment, and materials used in the trade. He also learns, among other things, how to lay out work, do rough framing, do outside and inside finishing work (for example, hanging doors, setting and finishing windows, fitting hardware, and flooring and stair work), weld, do acoustic and dry-wall construction, and erect scaffolding and shoring.

The apprentice receives related classroom instruction in drafting and blueprint reading, mathematics applicable to layout work, and the use of woodworking machines. Both in the classroom and on the job he learns the relationship between carpentry and the other building trades, because the work of the carpenter is basic to the construction process.

Hourly wage rates for apprentices usually start at about 50 percent of the journeyman rate and increase by about 5 percent in each 6-month period until a rate of 85 to 90 percent is reached during the last period of apprenticeship.

It is important for young men interested in entering the carpentry trade to obtain all-round training of the kind given in apprenticeship programs, particularly because of technological innovations that are increasingly affecting carpentry skills. Carpenters with such training will have especially favorable long-range job prospects. They will be in much greater demand and have better opportunities for advancement than those in the trade who can do only the relatively simple, routine types of carpentry work.

Carpenters may advance to carpenter foremen or to general construction foremen. Carpenters usually have greater opportunities than most

building craftsmen to become general construction foremen, since carpenters are 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 and employ other journeymen.

### Employment Outlook

Employment of carpenters—who numbered slightly more than 850,000 in early 1967—is expected to increase slowly through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, tens of thousands of carpentry jobs will be available each year, because of the need to replace experienced carpenters who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to provide about 20,000 job openings annually.

The large rise expected in construction activity (see discussion, p. 321) is expected to result in a growing demand for carpenters. In addition, more carpenters will be needed in the maintenance departments of factories, commercial establishments, large residential projects, and government agencies. However, employment growth will continue to be limited by technological developments. For example, the use of construction materials that are prepared off site is expected to increase. These materials, which include floors, partitions, and stairs, are designed for easy and speedy installation. Walls and partitions can be lifted into place in one operation. Beams and, in some instances, roof assemblies are lifted into place by cranes. With the standardization of prefabricated components, the use of such materials will increase further.

More widespread use of improved tools and equipment will increase the

efficiency of carpenters. Such products include new types of nails that have improved holding properties; hence, fewer nails and less hammering are required. Strong adhesives are being used that reduce the time needed to join pieces of wood and other materials. Power tools in use include stud drivers, screwdrivers, sanders, saws, staplers, and nailing machines. One type of power tool can drill and nail in one operation. New types of scaffolding are easier to erect, adaptable to varying construction situations, and safer to use.

Employment of carpenters will also be affected by the increased use of construction materials and techniques that reduce the amount of carpentry work required in residential buildings. For example, where houses are framed with steel, the use of curtain-wall panels, which can be quickly fastened into place, is possible. In addition to the speed with which they can be put in place, curtain-wall panels also may reduce the need for carpenters because they are available in nonwood materials such as glass, aluminum, and porcelain-coated steel. The use of plastics in building construction is in its infancy, but their greater use is expected. Already available are siding, curtain walls, partitions, roofing, ornamental screening, and insulation materials, made of plastic. Under development are foam plastic roofs and even entire houses of plastic that can be constructed on site.

### Earnings and Working Conditions

Union minimum hourly wage rates for carpenters averaged \$4.74, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for carpenters ranged from \$3.35 in Charlotte, N.C., to \$5.95 in New York City.



Like other building trades, the work of the carpenter is active and sometimes strenuous, but exceptional physical strength is not required. However, prolonged standing, as well as climbing and squatting, is 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. Many young persons like carpentry because they are able to work outdoors.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America.

**Where To Go for More Information**

For further information regarding carpentry apprenticeships or other work opportunities in this trade, inquiries should be directed to local carpentry contractors or general contractors; a local union of the United Brotherhood of Carpenters and Joiners of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment services screen applicants and give aptitude tests.

General information on apprenticeship in this trade is also available from:

Associated General Contractors of America, Inc.,  
1957 E. St. NW., Washington, D.C. 20006.

United Brotherhood of Carpenters and Joiners of America,  
101 Constitution Ave. NW., Washington, D.C. 20001

**CEMENT MASONS**

**(Cement and Concrete Finishers)**

(D.O.T. 844.884 and 852.884)

**Nature of Work**

The principal work of cement masons is finishing the exposed concrete surfaces on many types of construction projects. These projects range from small jobs, such as the finishing of patios, floors, and sidewalks, to work on huge dams, miles of concrete highways, foundations and walls of large buildings, airport runways, and missile launching sites. On small projects, a cement mason, assisted by one or two helpers, may do all the concrete work; on large projects, a crew of several cement masons and many helpers may be employed.

In preparing the site for pouring (placing) the concrete mixture (portland cement, sand, gravel, and water), the cement mason makes sure that forms, which hold the concrete, are set for the desired pitch and depth of the concrete mixture and are properly aligned. On larger (and wider) pours, a screed (guide) may be placed to section the pour into 12-15 foot widths, which allows easier handling and greater accuracy in the initial leveling process.

The cement mason directs the pouring of the concrete. He usually supervises the laborers who "strike off" (place and spread the mixture to its approximate level) the concrete using shovels or special rakes. The cement masons then level the surface further using a "straightedge" (a rod made of wood or lightweight metal long enough to extend across the freshly poured concrete), leaving the concrete ready for its intermediate and final finishing. The finisher works



the surface using special tools, such as a float, whip, or darby, to fill minor depressions and remove high spots. This agitation tends to draw surface fines (a rich mixture of cement and fine sand) to the top while imbedding coarser aggregate in preparation for the final finishing.

Final finishing is usually delayed until the concrete has hardened sufficiently to support the weight of a finisher on kneeboards. While the concrete is still workable, the craftsmen use handtools—a wood or magnesium float and a finishing trowel—to bring the concrete to the proper consistency and obtain the desired finish. Concrete finishing may also be done with the aid of power-operated trowels; however, edges, corners, and other inaccessible places for power-operated tools must still be finished by hand.

On most small building projects, such as sidewalks, driveways, and patios, concrete finishing generally involves hand operations. On highways and other large-scale projects, however, power-operated floats and cement finishing machines are used extensively.

On concrete work which is exposed (for example, columns, piers, ceilings, and wall panels), cement masons must correct surface defects and air pockets (often called honeycombs) when the forms are stripped from the hardened concrete. This involves preparing the surface with a rubbing brick (silicon carbide) to remove any high spots. A rich cement mixture is rubbed into the concrete surface using a sponge rubber float or piece of burlap cloth to fill the imperfections and voids. The end result is a smooth uniform appearance for the concrete surfaces.

Some cement masons specialize in laying a mastic coat (a fine asphalt mixture) over concrete, particularly in buildings where sound-insulated or acid-resistant floors are specified. The mastic is applied while hot, then smoothed, using heavy hand tools.

The cement mason's knowledge of his materials is essential to the quality

of his work. He must be familiar with the working characteristics of various cement and concrete mixes, such as those containing substances to speed or slow the setting time, and those which are used to construct weight-supporting walls or surfaces of specified strengths. In addition, because of the effects that heat, cold, and wind have on the curing of cement, the skilled mason must recognize by sight and touch what is occurring in the cement mixture so that he may be able to prevent defects and achieve the specified results.

### Where Employed

Cement masons work principally on large buildings, but many are employed on highway or other nonbuilding construction. Cement masons work directly for general contractors who are responsible for constructing entire projects such as highways, or large industrial, commercial, and residential buildings. They also work for concrete contractors who do only the concrete work on a large construction project or who work on smaller projects such as sidewalks, driveways, and basement floors. Some work for specialty floor contractors installing composition resilient floors, such as trowel applied epoxies, latex underlayments, and simulated terrazzo floors. A small number work for municipal public works departments, public utilities, and manufacturing firms which do their own construction work. Some cement masons are self-employed and do small cement jobs, such as sidewalks, driveways, patios, and curb and gutter work.

### Training and Other Qualifications

Most training authorities, including the National Cement Masonry, Asphalt, and Composition Joint (labor-management) Apprenticeship and Training Committee, recommend the completion of a 3-year apprenticeship program as the best

way to learn this trade. A substantial number of workers, however, have acquired some cement masonry skills informally by working for many years on building and road construction jobs as laborers assisting cement masons. Others have worked with specialty contractors constructing sidewalks and doing other masonry work. These workers have learned their skills by 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.

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, among other things, to use and handle the tools, equipment, and materials of the trade. He also learns finishing, layout work, and safety techniques. The apprentice 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

Employment of cement masons—estimated at about 55,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, thousands of job opportunities will result from the need to replace workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in about 1,000 job openings annually through the 1970's.

Employment of cement masons is expected to increase mainly because the anticipated rapid increase in construction activity (see discussion, p. 321) will be accompanied by the growing use of concrete and concrete products. Prestressed concrete makes possible wide spans where column-free construction is desired. Lightweight concrete wall panels that are fire- and weather-resistant are being used increasingly on nonload-bearing walls. These panels, available in different finishes, colors, and designs, can be speedily fastened into place. In some instances, buildings made with concrete wall panels can be easily dismantled and reerected elsewhere. Artistic and functional shapes can be incorporated into structures where prestressed concrete is used. In addition, the use of concrete and concrete products has expanded to include thinshell dome roofs, ornamental grill work, and slab and arch roofs in residential buildings; and bridge girders, columns, piles, and beams. Also, concrete can be poured year round by using heated, temporary shelters made of sheet plastic.

Employment of cement masons is not expected to increase as rapidly as the use of cement and concrete products, because many concrete products are now precast away from the construction site and these products generally do not require finishing. The efficiency of on-site masons also has increased through the use of new and improved construction methods, materials, and equipment. Concrete slabs for floors and roofs can be processed at ground level and raised into place with synchronized hydraulic jacks or cranes. Walls can be processed in the same manner and tilted into place. For certain jobs, concrete can be applied pneumatically through hoses. Glass-fiber-reinforced plastic forms provide a smooth surface, eliminating rubbing and patching work. Steel and plastic-covered wood forms that can be reused many times are now available. Adhesives eliminate the need for bolts and other types of fasteners. Worker

efficiency has also been increased by the introduction in recent years of new machines, including powered concrete conveyors, such as powered wheelbarrows; portable, powered screeds; electric concrete vibrators; hydraulic joint-forming machines; powered concrete cutting saws; and cement-finishing machines.

### Earnings and Working Conditions

Union minimum hourly wage rates for cement masons averaged \$4.57, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for cement masons ranged from \$3.10 in Norfolk, Va., to \$6.00 in New York City.

Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. Overtime work for these craftsmen often arises, because once concrete has been poured the work must be completed.

The work of the cement mason is active and strenuous, like the work of skilled building tradesmen generally. Since most cement finishing is done on floors or at ground level, the cement mason is required to stoop, bend, or kneel. Much of his work is done outdoors.

A large proportion of cement masons are union members. They belong either to the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or to the Bricklayers, Masons and Plasterers' International Union of America.

### Where To Go for More Information

For further information regarding cement mason apprenticeships or other work opportunities in the trade, inquiries should be directed to local cement finishing contractors; locals

of unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of cement masons may be obtained from:

Associated General Contractors of America, Inc.,  
1957 E St. NW., Washington, D.C.  
20006.

Bricklayers, Masons and Plasterers' International Union of America,  
815 15th St. NW., Washington, D.C.  
20005.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada.  
1125 17th St. NW., Washington, D.C. 20036.

### CONSTRUCTION LABORERS AND HOD CARRIERS

(D.O.T. 809.887; 844.887; 850. through 852.887; and 859. through 862.887)

#### Nature of Work

Construction laborers work on all types of building construction and on other types of construction projects, such as highways, dams, pipelines, and water and sewer projects. Their work includes the loading and unloading of construction materials at the worksite and the shoveling and grading of earth. Laborers stack and carry materials, including small units of machinery and equipment, and do other work that aids building craftsmen. They also erect and dismantle scaffolding, set braces to support the sides of excavations, and clean up



Construction crew releases concrete from bucket.

rubble and accumulated debris to provide clear work areas.

On alteration and modernization jobs, laborers tear out the existing work. They perform much of the work done by wrecking and salvage crews during the demolition of buildings.

When concrete is mixed at the worksite, laborers unload and handle materials and fill hand-loaded mixers with ingredients. Whether the concrete is mixed on-site or hauled in by truck, laborers pour and spread the concrete, and spade or vibrate it to prevent air pockets. In highway paving, laborers clean the right-of-way, fine grade and prepare the site, handle

and place the forms into which wet concrete is poured, and cover new pavement with straw, burlap, or other materials to prevent excessive drying.

*Bricklayers' tenders* and *plaster tenders*, both commonly known as hod carriers, serve journeymen in their respective trades, mixing and supplying materials, setting up and moving portable scaffolding, and providing the many other services needed. Hod carriers must be familiar with the work of the journeymen and have some knowledge of the materials and tools used. It is customary practice in the building trades for hod carriers to be transferred with the journeymen from one construction

project to another. Laborers also tend cement finishers, and some who have started as laborers have learned that trade.

Building and construction laborers are commonly classified as unskilled workers, but this term can be misleading. Their work covers a wide range of requirements. Some types of construction-laborer and hod-carrier jobs often require training and 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. Construction laborers who work with explosives drill holes in rock, handle explosives, and set charges. These workers must know the effects of different explosive charges under varying rock conditions so that proper measures can be taken to prevent injury and property damage. Construction laborers learn how to handle and use blasting materials through job experience and instruction from foremen in charge of blasting work. Also, in the construction of tunnels, and dam and bridge foundations, construction laborers must have specific on-the-job experience. They do all the work in the pressurized area of a tunnel, including operations which would be done by journeymen if the job were located elsewhere.

### Where Employed

Laborers are employed by all types of construction contractors. 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 and maintenance, and excavating.

### Training, Other Qualifications, and Advancement

Little formal training is required to obtain a job as a building or construction laborer. Generally, to be employed in these jobs, 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. If he works closely with a skilled craftsman for several years, he may be able to pick up the skills of the trade. However, in their work as construction laborers, relatively few workers have such opportunities.

### Employment Outlook

Employment of construction laborers and hod carriers—estimated at about 750,000 in early 1967—is expected to increase slowly through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. However, thousands of additional job openings will arise from the need to replace workers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide about 13,000 job openings annually.

The anticipated large increase in construction activity (see discussion, p. 321) is expected to result in a growing demand for laborers and hod carriers, but the increase in their employment will be sharply limited by more widespread use of mechanized equipment. For example, construction materials formerly handled at the construction site, such as brick, concrete, and lumber, are moved by forklift trucks, powered wheelbarrows, and conveyor belts. Materials are lifted to the upper floors of multistoried buildings by automatic lifts and heavy duty cranes. The use of earth moving machines, including specialized equipment such as trenchers and front-end loaders, is also increasing.

### Earnings and Working Conditions

Union minimum hourly wage rates for bricklayers' tenders and building laborers averaged \$3.93 and \$3.56, respectively, as of July 1, 1966, ac-

ording to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for bricklayers' tenders ranged from \$1.95 in Jackson, Miss., to \$5.05 in New York City. The rates for building laborers ranged from \$1.90 in Norfolk, Va., to \$5.20 in New York City.

Construction work is physically strenuous since it requires frequent bending, stooping, and heavy lifting. Much of the work is performed outdoors. Many laborers are members of the Laborers' International Union of North America.

### Where To Go for More Information

For further information regarding work opportunities as a construction laborer, inquiries should be directed to local building or construction contractors, or a local of the Laborers' International Union of North America. In addition, the local office of the State employment service is a source of information about work opportunities.

General information about the work of construction laborers may be obtained from:

Laborers' International Union of  
North America,  
905 16th St. NW., Washington, D.C.  
20006.

### ELECTRICIANS (CONSTRUCTION)

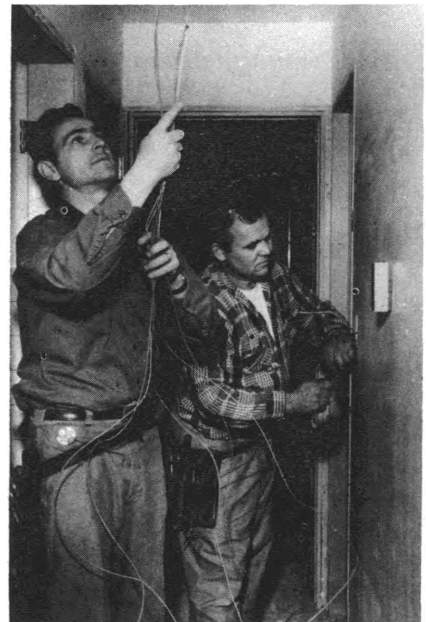
(D.O.T. 821.381; 824.281; and 829.281  
and .381)

### Nature of Work

Construction electricians lay out, assemble, install, and test electrical fixtures, apparatus, and wiring used in electrical systems. The systems, once installed, are used to provide heat, light, power, air conditioning, and refrigeration in residences, office buildings, factories, hospitals, schools,

and other structures. Construction electricians also install and connect electrical machinery, electronic equipment, controls, and signal and communications systems. (Maintenance electricians do work which is similar in many respects to that performed by construction electricians. A discussion of maintenance electricians is presented elsewhere in the *Handbook*.)

Construction electricians usually follow blueprints and specifications when installing various electrical components. If there is no electrical drawing, the electrician terminates the incoming electrical service into a central load center with overload protective devices and installs interior circuits and outlets according to the amount of electrical current expected to be used in the various sections of the building. He installs fuses or circuit breakers of the proper rating in the incoming and interior circuits to prevent overloading, which causes overheating of wires, appliances, and motors. The construction electrician must know and follow National Electrical Code regulations and, in addition, must fulfill State, county, and municipal regulations.



Construction electricians run wire to wall switch.

In installing wiring, the construction electrician uses a mechanical or hydraulic bender to shape conduit (pipe or tubing) so that the conduit will fit the contours of the surface to which it is attached, or within the space allotted. He then pulls insulated wires or cables through the conduit. The electrician then connects the ends of the wires or cables to circuit breakers, switch-gear motors, transformers, or other components. When these operations are completed, the electrician tests the electrical circuits to make sure that the entire system is properly grounded, the connections properly made, and the circuits do not carry excessive current. Wires are spliced (joined) by soldering or mechanical means.

The electrician furnishes his own handtools, such as pliers, screwdrivers, brace and bits, knives, and hacksaws. The employer furnishes test meters and heavier tools and equipment, such as pipe threaders, conduit benders, chain hoists, electric drills, power fasteners, and ladders. In residential electrical construction work, heavier tools are not usually required.

### Where Employed

Most construction electricians work for electrical contractors. Substantial numbers are self-employed. Others work for government agencies or business establishments that do their own construction electrical work. Construction electricians usually work for a large number of different employers during their work life because of the intermittent needs of individual contractors. However, many construction electricians work for the same electrical contractor for several years. 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.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for the Electrical Industry, recommend the completion of a 4-year apprenticeship program for construction electricians as the best way to learn all the aspects of this trade. However, in the past, some construction electricians have acquired skills of the trade informally by working for many 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, or through special training when in the Armed Forces.

The International Brotherhood of Electrical Workers and the National Electrical Contractors Association have jointly developed an extensive apprenticeship program. Apprenticeship applicants generally are required to be between the ages of 18 and 24, but exceptions may be made for veterans. A high school education is required; courses in mathematics and physics are desirable. Applicants are usually required to take tests to determine their aptitude for the trade.

All apprenticeship programs are conducted under written agreement between the apprentice and the local joint union-management apprenticeship committee, which supervises the training. The committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards, 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.

The apprenticeship program usually requires 8,000 hours (4 years) of on-the-job training, in addition to a minimum of 144 hours of related classroom instruction each year. In a typical 4-year training program, the construction electrician apprentice

learns, among other things, to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; do residential, commercial, and industrial electrical installations; and maintain and repair installations. In addition, he receives related classroom instruction in such subjects as electrical layout, blueprint reading, mathematics, and electrical theory, including electronics. After completing their apprenticeship programs, many journeymen electricians enroll in courses, which may include advanced electronics, to keep abreast of the latest developments in this rapidly changing occupation.

Hourly wage rates of apprentices usually start at 40 to 50 percent of the journeyman rate and increase by 5 percent in each 6-month period until 80 to 85 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 hazardous, most cities 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 construction electricians go into business for themselves. As they expand their activities, they may employ other workers and become contractors. In most large urban areas, a master electrician's license is required in order to engage in an electrical contracting business.

## Employment Outlook

Employment of construction electricians—who numbered more than 175,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition to the growth that is anticipated in the trade, many thousands of job opportunities will result from the need to replace experienced workers who transfer to other types of electrical work, leave the trade for other reasons, retire, or die. Retirement and deaths alone will result in about 3,100 job openings annually.

The increase in employment of electricians is expected mainly because of the anticipated large expansion in construction activity. (See discussion, p. 321.) Other factors expected to contribute to the growth of this trade are greater requirements for electric outlets, switches, and wiring in homes to accommodate the increasing use of appliances and air-conditioning systems; and the extensive wiring systems needed for the installation of electronic data-processing equipment and electrical control devices being used increasingly in commerce and industry. Other recent developments expected to expand the demand for construction electricians include an increase in the number of "all-electric" homes, and the use of outdoor radiant heating, and snow- and ice-melting systems.

Technological developments are expected to limit the employment growth of this trade. A major technological development increasing the efficiency of electricians is the prefabrication of electrical equipment. For example, preassembled conductors and raceways that can be installed in one operation are available. Switch boxes and switchboards, which formerly had to be wired on site, are now preassembled at the factory. Also available are "packaged"

(preassembled and prewired) ceiling units, which the electrician connects to the power source, eliminating the need to wire the complete system and install the fixtures.

Improved tools and equipment being used increasingly by electricians include more efficient conduit benders; multiple spindle drills; cordless electric drills, saws, and other tools; and "kits" of splicing materials that have reduced the time needed to do field insulation of cable splices.

## 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 less than most other construction workers, their annual earnings generally are among the highest in the building trades.

Union minimum hourly wage rates for electricians averaged \$4.98, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the union minimum hourly rates for construction electricians ranged from \$3.60 in Charlotte, N.C., to \$5.88 in Oakland, Calif.

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 and scaffolds, cuts from sharp tools, electrical shock, blows from falling objects, and burns from "live" wires. However, safety practice learned during ap-

prenticeship and other types of training have helped to reduce the injury rate for these workers. The number of injuries per million man-hours worked by employees in contract electrical work has been lower than in contract construction work as a whole, but higher than that for production workers in manufacturing industries.

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers.

## Where To Go for More Information

For further information regarding electrician apprenticeships or other work opportunities in the trade, inquiries should be directed to local electrical contractors; a local union of the International Brotherhood of Electrical Workers; a local joint union-management apprenticeship committee, or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

General information about the work of electricians may be obtained from:

International Brotherhood of Electrical Workers,  
1200 15th St. NW., Washington, D.C. 20005.

National Electrical Contractors Association,  
1730 Rhode Island Ave. NW., Washington, D.C. 20036.

National Joint Apprenticeship and Training Committee for the Electrical Industry,  
1730 Rhode Island Ave. NW., Washington, D.C. 20036.

## ELEVATOR CONSTRUCTORS

(D.O.T. 825.381)

### Nature of Work

Elevator constructors (also called *elevator mechanics*) assemble and install elevators, escalators, dumb waiters, and similar equipment. They also do considerable modernization, maintenance, and repair work. The work is done by small crews consisting of skilled mechanics and their 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 hoisting machine, 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.

In maintenance and repair work, elevator mechanics 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 is generally replaced.

To install and repair modern elevators, most of which are electrically controlled, elevator constructors must have a working knowledge of electricity, electronics, and hydraulics. They must also be able to repair electric motors, as well as control and signal systems. Because of the variety of their work, they use many different handtools, power tools, and mechani-

cal and electrical testing meters and gages.

### Where Employed

Most of the estimated 14,000 journeymen elevator constructors employed in early 1967 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 that do their own elevator maintenance and repair. Elevator constructors are also employed as elevator inspectors for municipal or other government licensing and regulatory agencies.

### Training and Other Qualifications

Although elevator constructors are among the 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.

To become a skilled elevator mechanic, at least 2 years of continuous job experience, including 6 months' on-the-job training at the factory of a major elevator firm, is usually necessary. During this period, the helper learns to perform all of the operations involved in the installation, maintenance, and repair of elevators, escalators, and similar equipment. The helper-trainee generally attends 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

A slow increase in employment of elevator constructors is expected through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, a few thousand job opportunities for new workers will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Employment growth and retirements and deaths in this small occupation will provide about 500 job openings annually.

More elevator constructors will be needed as the result of the anticipated large expansion in new industrial, commercial, and large residential building. (See discussion, p. 321.) In addition, technological developments in elevator and escalator construction will spur modernization of older installations and thus will contribute to the growing need for these craftsmen. For example, modern high speed elevators with automatic control systems 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.

Union minimum hourly wage rates for elevator constructors averaged \$5.05, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among the individual cities surveyed, the minimum hourly rates for elevator constructors ranged from \$3.96 in Nor-





Elevator constructor adjusts mechanism that operates elevator doors.

structors, or a local of the International Union of Elevator Constructors. In addition, the local office of the State employment service may be a source of information about work opportunities in this trade.

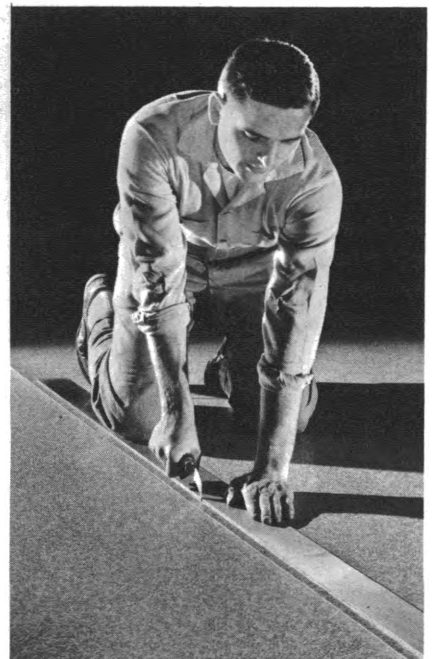
General information about the work of elevator constructors may be obtained from the International Union of Elevator Constructors, 12 South 12th St., Philadelphia, Pa. 19107.

## FLOOR COVERING INSTALLERS

(D.O.T. 864.781)

### Nature of Work

Floor covering installers (also called *floor covering mechanics* and *floor layers*) install, replace, and repair resilient tile, linoleum and vinyl sheet goods, and carpeting on the floors of residential, commercial, and industrial buildings. The craftsman installs these coverings over wood, concrete, metal, and other subfloors which may vary in size from a small



folk, Va., to \$5.96 in Newark, N.J., and New York City.

Some work operations in elevator construction involve lifting and carrying heavy equipment and elevator parts, but this is usually done by helpers. Some of the work must be done in cramped or awkward positions. Most of the work is done indoors.

Most elevator constructors are members of the International Union of Elevator Constructors.

### Where To Go for More Information

For further information regarding work opportunities as a helper in this trade, inquiries should be directed to elevator manufacturers, elevator con-

kitchen or bathroom to a large super-market floor or hotel lobby.

When installing resilient floor covering, such as asphalt tile or vinyl sheet goods, the floor covering installer first inspects the floor to be covered to make sure that it is firm, dry, smooth, and free of loose dust or dirt. He may sand a rough or painted floor; fill cracks, indentations, or other irregularities with a filler material; or, if a floor is extremely uneven, re-surface it with plywood, hardboard, or mastic underlayments.

The installer may also test for moisture content in newly poured concrete floors or floors laid over earthwork at ground level or below. If the moisture in the floor is too great, he may suggest postponing installation of floor covering or recommend a type of adhesive or floor covering technique particularly suited to the condition of the floor. For this reason, the installer should be familiar with the many types of adhesives and floor coverings recommended by manufacturers for specific subfloor conditions.

The floor covering installer prepares for the installation of resilient floor covering by carefully measuring and marking off the floor in accordance with the floor covering plan. The plan may be in the form of architectural drawings specifying every detail of the floor covering design, or it may be a simple, verbal description by the customer. When the floor layout is completed, the craftsman, assisted, when necessary, by an apprentice or other worker, cuts and fits the flooring material, applies the proper adhesive, and installs the floor covering. He must be careful in cutting, matching, and fitting floor covering, particularly at door openings, along irregular wall surfaces, and around permanent floor fixtures, such as columns or piping. Special care must be taken in cutting out and setting in decorative designs in the flooring. After the flooring is installed, a floor roller is run over it to insure good adhesion to the subfloor.

The carpet craftsman, like the installer of resilient floor coverings, first inspects the floor to be covered to determine its condition. Then he plans his layout carefully to minimize waste of materials. He also allows for expected foot-traffic patterns so that best appearance and long wear will be obtained, and that carpet sections expected to receive heavy traffic can be replaced easily.

When installing the carpet, the installer may fasten "tackless strip," with adhesive or nails, along the borders of the installation. (The strip secures the carpet when it is installed.) Instead of using strip, the floor layer may use tacks to secure carpeting. Padding, which is placed under the carpet, is cut and placed within the framework of the strip and the carpet is then placed approximately into position. If the carpet has not been pre-cut and seamed in the workroom of the floor covering firm, the installer will do this work before stretching the carpet into place. He then trims the edge of the carpet so that it will be held securely and smoothly by tacks, or by nails protruding from the border strip. Finishing touches may include the use of a special roller to obscure seam markings that may result when carpet sections are joined.

Floor covering craftsmen generally specialize either in carpet installations or resilient floor installations, although some mechanics can install both types of coverings. Some may specialize even further. For example, the most skilled installers generally are employed by commercial floor covering firms which install the more expensive carpeting, and resilient sheet flooring with many intricate designs. Many floor installers specialize in the installation of resilient tile. Some also install resilient wall and counter coverings.

The tools used by floor covering installers include hammers; pry bars; knives, shears, and other cutting devices; measuring and marking tools, such as tape measures, compasses,

straightedges, scribes, chalk, and chalklines; and a variety of specialized tools, such as notched adhesive trowels, carpet stretching devices, and floor rollers.

### Where Employed

Most floor covering installers are employed by flooring contractors who may specialize in commercial and industrial flooring work, in residential floor covering, or in specific types of installations, such as resilient tile. Many others work for retailers specializing in floor covering who provide installation service. Floor covering installers also are employed by furniture and department stores that sell and install floor coverings, and by home alteration and repair contractors.

Heavy concentrations of these workers are found in large business centers where high levels of commercial construction as well as residential building prevail.

### Training, Other Qualifications, and Advancement

In considering applicants for floor covering installation jobs, employers are particularly interested in those with manual abilities. They prefer applicants with a high school education, but this qualification is not generally required. Most employers want applicants between 17 and 30 years of age and with at least average physical strength. A neat appearance and a pleasant business-like manner are important attributes because the work is performed on the customer's premises.

Training authorities generally recommend a 3- or 4-year apprenticeship program as the best way to learn the floor covering trade. Most apprenticeship programs include 6,000 hours (3 years) or 8,000 hours (4 years) of on-the-job training in addition to related classroom instruction. In these training programs, the trainee learns the techniques of floor covering in-

stallation and how to handle the tools of the trade. Through work assignments with skilled craftsmen on a wide variety of floor covering jobs, he learns to plan and execute different types of jobs in a minimum of time and with the most efficient and decorative use of materials. Most apprentices are required to attend class twice a week to learn about the nature of the materials they will be using, the use and care of tools and equipment, mathematics of layout work, interpretation of architectural drawings, and planning and layout of floor covering installations.

Some apprenticeship programs may combine training in the installation of resilient floor and wall covering with training in laying of carpets. Other programs may be limited to the installation of resilient coverings.

Many workers in this trade have acquired their skills through informal training methods, such as working as a trainee or laborer, and observing or being taught by experienced floor covering installers. Many of these men have also gained some knowledge of floor covering installation by attending trade school or floor covering manufacturers' training courses, and through home study.

Many informal training programs limit the trainee's work experience to installation of resilient tile, or to residential floor covering work of limited complexity. This lack of all-round experience, however, may be partially offset by trade school and home-study courses and manufacturers' training programs. A young man interested in becoming a floor covering installer should direct inquiries to several firms about their training programs before accepting employment as a trainee.

Skilled floor covering installers may advance to the position of foreman or installation manager for a large floor laying firm. Some become salesmen or estimators for floor covering firms. Floor covering installers with business ability may form their own firms and employ their own mechanics.

## Employment Outlook

Employment of floor covering installers—estimated at about 36,000 in early 1967—is expected to increase moderately during the rest of the 1960's and over the next decade, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. Many additional job openings will arise from the need to replace experienced workers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide nearly 900 job openings annually through the 1970's.

The projected increase in employment of floor covering installers is expected mainly because of the anticipated expansion in construction activity. (See discussion, p. 321.) Moreover, the use of resilient floor coverings and wall-to-wall carpeting will become more widespread. More versatile materials and colorful patterns are expected to contribute to a growing demand for floor coverings. For example, epoxy (a plastic) is now being used as a floor covering material. This relatively new material is extremely durable and can be used in many ways—as a solid floor covering that can be painted a variety of colors, and as an adhesive or base for laying resilient flooring.

The best job opportunities will be for floor installers with all-round training in the installation of resilient tile and sheet goods or carpeting.

## Earnings and Working Conditions

No national wage data on floor covering installers are available. However, wage information from a limited number of firms indicates that, in early 1967, most experienced floor layers were paid between \$4 and \$5 per hour, although wage rates for skilled workers ranged from about \$3 an hour in some areas to as much as nearly \$6 an hour in others. Wage rates for such workers may also vary within an area because of differences in level of skill or degree of work

specialization. Starting wage rates for apprentices and other trainees usually are about half of the mechanic's rate.

Most floor covering craftsmen, including those under union-management agreements, are paid on an hourly basis. In some nonunion shops, part of the installer's pay may be in the form of bonuses for work performed within a specified time period. In others, installers receive a monthly salary or are paid on the basis of the number of square feet or square yards of floor covering they install.

Floor covering installers generally work regular daytime hours. Particular circumstances, however, such as installing a floor in an occupied home, store, or office, may require work during evening hours or on weekends when families are at home or stores and offices are not open for business.

Floor covering installation work is usually not affected by weather conditions, since it is performed indoors. During the winter months most work is done in heated buildings. Job hazards are not numerous, but installers frequently experience knee injuries because they do much of their work while kneeling; back injuries occur occasionally as a result of twisting and lifting on the job. Most of these injuries can be avoided, however, if proper work procedures are followed. Generally, an installer is assisted by a helper in heavy lifting, and usually has proper equipment available to move heavy objects.

## Where To Go for More Information

For further information regarding floor covering apprenticeships or other work opportunities in this trade, inquiries should be directed to local flooring contractors or floor covering retailers; a local union of the United Brotherhood of Carpenters and Joiners of America (in Eastern States); a local union of the Brotherhood of Painters, Decorators and Paperhangers of America (in Western States); or the nearest office of the State apprenticeship agency or the Bureau of

Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about apprenticeship, the Manpower Development and Training Act, and other programs that provide training opportunities.

Publications providing detailed information about training for this trade are available from:

American Carpet Institute,  
Empire State Bldg., New York, N.Y.  
10001.

Armstrong Cork Co.,  
Lancaster, Pa. 17604.

Congoleum-Nairn, Inc.,  
195 Belgrove Dr., Kearny, N.J.  
07032.

## GLAZIERS

(D.O.T. 865.761)

### Nature of Work

Glaziers engaged in construction work cut, fit, and install plate glass, ordinary window glass, mirrors, and special items such as leaded glass panels. In making a glass installation, the glazier cuts the glass to size or uses precut glass. The glazier puts a bed of putty into the wood or metal sash (frames) and presses the glass into place. He fastens the glass using 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. 343) applies mastic cement to the supporting backing and presses the glass into it. The glass may have to be trimmed with a glass cutter if it is not precut to specifications. Glaziers generally install all types of structural glass, both interior



Glaziers position glass panel.

and exterior, that is set or glazed with putty, moulding, rubber, and mastic. For example, they install shower doors and bathtub enclosures, mirrors of all types, and window glass. These craftsmen also set a wide variety of automatic doors, hinges, and fabricated units constructed of glass that are installed in many buildings.

In addition to handtools, such as glass cutters and putty knives, glaziers use power cutting tools and grinders.

### Where Employed

Most of the estimated 6,000 construction glaziers employed in early 1967 worked for glazing contractors engaged in new construction, alteration and modernization work, and on replacement of broken glass, particularly for store windows. Some glaziers were employed by govern-

ment agencies or business establishments which do their own construction work.

(About 12,000 glaziers worked outside the construction industry. Many are employed in factories where they install glass in sash, doors, mirror frames, and partitions. Others, using skills similar to those used by glaziers, install glass or mirrors in furniture and ships, or replace glass in automobiles.)

### Training and Other Qualifications

Most training authorities, including the National Joint (labor-management) Glazier and Glassworker Apprenticeship Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn the skills of the construction glazier. A substantial proportion of

glaziers, however, have learned the trade informally. They have acquired their skills by working for many years with experienced glaziers and observing or being taught by them. In smaller communities, many journeymen painters and paperhangers have learned to do glazier work as part of the apprentice training for their trade.

Apprenticeship applicants generally are required to be at least 18 years of age, but they should not have reached their 26th birthday. Eligible veterans are exempt from the maximum age limit. A high school diploma or its equivalent is required.

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 trainee learns how to use and handle the tools, machines, and materials of the trade. Instruction is given in safety measures and first aid, and the reading of specifications and blueprints, and scaffolding. The program also includes on-the-job training in the glazing of wood and metal sash in doors, windows, partitions, and other openings; and the setting and replacement of all types of store front installations, structural glass, mirrors, showcases, partitions and fixtures, and automobile glass.

Hourly wage rates for glazier apprentices usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of training.

### Employment Outlook

A rapid increase in employment of construction glaziers is expected through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, job opportunities will result from the need to replace experienced construction glaziers who transfer to other fields of work, retire, or die.

The large increase anticipated in construction activity (see discussion, p. 321) and the increasing use of glass in building construction are expected to result in more work for construction glaziers. Replacement and modernization work, frequently involving large glass installations, will also contribute to the demand for these workers. The long-range outlook for this occupation generally can be considered very favorable.

### Earnings and Working Conditions

Union minimum hourly wage rates for construction glaziers averaged \$4.47, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the union minimum hourly wage rates for construction glaziers ranged from \$2.83 in Jackson, Miss., to \$5.65 in New York City.

Glaziers are exposed to some hazards in their work, such as cuts from glass edges and sharp tools used in cutting glass, back injuries caused by lifting plate glass, and falls from scaffolding. However, employers and unions attempt to eliminate injuries by promoting safety training and procedures.

A large proportion of glaziers employed in construction work are members of the Brotherhood of Painters, Decorators, and Paperhangers of America.

### Where To Go for More Information

For further information regarding glazier apprenticeships or other work opportunities in this trade, inquiries should be directed to local glazing contractors or general contractors; a local of the Brotherhood of Painters, Decorators and Paperhangers of America; a local joint union-management apprenticeship committee; or the nearest office of the State appren-

ticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower and Development Training Act, apprenticeship, and other training opportunities.

General information about the work of glaziers may be obtained from the Brotherhood of Painters, Decorators and Paperhangers of America, 1925 K St. N.W., Washington, D.C. 20006.

### LATHERS

(D.O.T. 842.781)

### Nature of Work

Lathers install the support backings on which plaster, stucco, or concrete materials are applied. These supports are usually of two types—metal lath (strips of expanded metal or a metal wire mesh) or gypsum lath. The plaster easily adheres to either type of lath when mixed to the proper proportion and consistency.

When installing metal lath, the lathers first build a light metal framework (furring), which is fastened securely to the structural framework of the building. On ceilings or interior walls, the lath may be attached directly to the wood framework or partitions. Attachment to the furring or framework may be done by nailing, clipping, tying, or machine stapling. As the lath is being installed, the lathers cut openings for electrical outlets and piping.

Gypsum lath is installed in much the same way. These lath boards are usually 16 by 48 inches ( $\frac{3}{8}$  inch thick) and cover three studs (upright 2 by 4 inches framework, placed 16 inches on center). The gypsum lath is cut using a lath hatchet by



Lather nails gypsum lath to house framework.

scoring one side, and then easily broken with a sharp blow on the opposite side. Openings for electrical outlets and other openings must be cut before attaching the lath to the wall or ceiling.

Lathers also install wire mesh reinforcement in all inside angles and corners to prevent structural cracking. On outside or exposed corners, a metal reinforcement called a corner bead is attached as a guide for the plasterer. It provides protection and structural strength to the finished corner.

Lathers also install the metal studs and framework for metal interior partitions which receive lath and plaster or gypsum board. They erect the light iron furring which supports acoustical ceilings.

The method of installation varies slightly in other types of lath work. For example, when cornices or other ornamental plaster shapes are specified, the lather builds the framework that approximates the desired shape

or form. Metal lath is then attached to the framework by the lather.

When stucco (a mixture of portland cement and sand) is to be applied over wood framework, the lather installs two layers of wire mesh separated by a layer of felt, to act as a base.

The tools of the trade include measuring rules and tapes, drills, hammers, chisels, hacksaws, shears, wirecutters, boltcutters, punches, pliers, hatchets, and stapling machines.

### Where Employed

Most lathers—who numbered nearly 30,000 in early 1967—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.

### Training and Other Qualifications

The National Joint (labor-management) Apprenticeship Committee for the Lathing Industry and many other training authorities recommend the completion of a minimum of 2 years of apprenticeship as the best way to learn lathing. However, many lathers, particularly in small communities, have acquired skills informally, by working for many years as helpers, observing or being taught by experienced lathers.

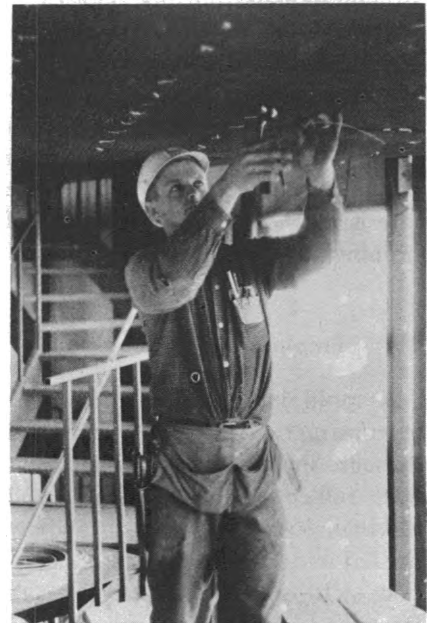
Apprenticeship applicants generally are required to be between the ages of 16 and 26, and in good physical condition. Aptitude tests are often given to applicants to determine whether they have manual and finger dexterity as well as the other qualifications required. Apprentices generally must pass examinations that are given at the end of each 6-month period.

During the apprenticeship period, the apprentice learns to use and handle the tools and materials of the trade. For example, he installs gypsum lath, wall furring, and metal lathing. In addition, he generally receives related classroom instruction in subjects such as applied mathematics, geometry, reading of blueprints and sketches, welding, estimating, and safety practices. Today, a high school education is encouraged, and education above grade school level, particularly courses in mathematics, is needed to understand the classroom instruction.

Hourly wage rates for lather apprentices usually 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

Employment of lathers is expected to increase moderately during the remainder of this decade and over



Lather attaches metal lath to ceiling using wire and pincers.

the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, many job opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in about 500 job openings annually.

Growth of the trade will result principally from the anticipated large increase in construction activity. (See discussion, p. 321.) Moreover, there will be a growing need for lathing work because of the increasing use of new kinds of plaster and improved methods of applying plaster. Improved, lightweight plasters are being used increasingly because of their excellent fireproofing qualities and ease of handling. There is also a 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 and acoustical effects. The use of "plaster veneer" as a surface finish is expected to expand because of time and cost economy. Machine plastering and fireproofing are growing in importance. Because these machines reduce the cost of plastering, their greater use should increase the demand for plaster work and for lathers. These developments are expected to more than offset the loss of lathing work resulting from the use of non-plaster (dry-wall) construction.

### Earnings

Union minimum hourly wage rates for lathers averaged \$4.80, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for lathers ranged from \$3.00 for gypsum lathers in Norfolk, Va., to \$5.80 for metal lathers in New York City.

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union.

### Where To Go for More Information

For further information regarding lathers' apprenticeships or other 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; a local joint labor-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of lathers may be obtained from:

Contracting Plasterers' and Lathers' International Association,  
304 Landmark Bldg., 1343 H St. NW., Washington, D.C. 20005.

National Bureau for Lathing and Plastering,  
938 K St. NW., Washington, D.C. 20001.

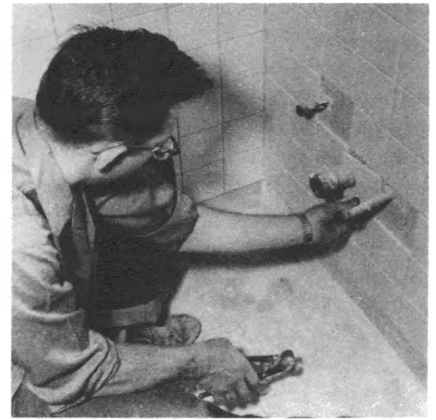
The Wood, Wire and Metal Lathers International Union,  
6530 New Hampshire Ave., Takoma Park, Md. 20012.

### MARBLE SETTERS, TILESETTERS, AND TERRAZZO WORKERS

(D.O.T. 861.381 and .781)

#### Nature of Work

Marble setters, tilesetters, and terrazzo workers cover interior or exterior walls, floors, or other surfaces



Tile setter fits piece around waste pipe with aid of pincers.

with marble, tile, or terrazzo. Craftsmen in each of these distinct trades work primarily with the material indicated by their job title.

Marble setters install marble, shop-made terrazzo panels and artificial marble, and structural glass when it is used in a building interior. 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 do some minor cutting to make the materials fit exactly. In setting marble, he lays out the work, drills anchors holes in the marble for wall-work, fastens the non-ferrous anchors to the marble, and 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 grout is packed into the joints between the marble pieces, and the joints are "pointed up" (slightly indented) with a pointing trowel or wooden paddle. Bolt holes have to be drilled if attachments to the marble are necessary, and for the installation of all marble toilet and shower compartments. The setting of marble on floors involves the preparation of the portland cement mortar, applying sufficient mortar for one piece of marble, and then placing the marble on the mortar and tamping it to the proper elevation.



**Terrazzo worker trowels top course of cement and marble chips.**

The craftsman then removes the marble piece, brushes or trowels a coat of neat cement to the back surface and, finally, resets the piece of marble on the setting bed and retamps it to the proper line and elevation. Each marble setter has a helper to prepare plaster, carry marble slabs, and clean the surface of the completed work.

The tilesetter attaches tile (a thin slab of baked clay, stone, or other material) on walls, floors, or ceilings according to blueprints or other instructions. For floors, the tilesetter applies a setting bed to the surface or other supporting backing. This setting bed consists of a float coat of sand, cement, and a small amount of lime, plus a bond coat of pure portland cement mixed with water, or one of a number of patented portland cement mixtures. This bond coat is

troweled directly on the mortar setting bed or is applied to the back of each individual tile, but regardless of the method used, it is done immediately before the placement of the individual tiles to the setting bed. With patented portland cement mixtures, one can wait for the setting bed to harden and using the same procedure, set the tile on the hardened setting bed the following day or even the following week. Tiles are tapped into place on the setting bed with a trowel handle. In laying tile floors, the tilesetter applies the mortar setting bed on the floor, tamping the mortar firmly and screeding the bed to the correct elevation. A bond coat of neat cement is then brushed or troweled to the setting bed or to the back of the tiles. The craftsman places the tile on the setting bed, and they

are tapped firmly into the mortar. He chips the tile with a hammer and chisels or cuts it with pincers to make it fit into irregular areas, into corners, or around pipes.

Small tiles, such as those laid in bathrooms, are available on paper-backed strips and sheets that can be attached to the floor as a unit, using portland cement or various adhesives. This eliminates the setting of individual tiles. The tilesetter usually is assisted by a helper who mixes mortar, sets up scaffolds, supplies the setter with materials, grouts (fills) the joints after the tile setting is completed, and cleans the completed work.

Terrazzo is a type of ornamental concrete used mainly for floors. Marble chips are used as the coarsest concrete ingredient. After the terrazzo hardens, it is ground and polished to give a smooth surface in which the marble chips are exposed against the background of the matrix (the material with which the chips are mixed).

A terrazzo worker starts his work by laying a base of concrete mortar. When laying a concrete base, he levels it with a long, flat tool called a straightedge, and tamps it. Then he places metal strips in the base, wherever there is to be a joint or a change of color between panels, and imbeds their bottom edges into the base. If there is to be lettering or an ornamental figure, he also imbeds a shop-made mold. Finally, he mixes the top course of cement and marble chips, pours it onto the base, and rolls and levels it. A separate mixture is made for each color. Where no base is required, the craftsman mixes the marble chips with epoxy or polyester resins or latex and this mixture is poured directly onto the floor. After the mixture has hardened for a few days, a terrazzo helper grinds and polishes the floor with an electric-powered grinding machine.

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 used by the terrazzo worker. They rub and clean all marble, mosaic, and terrazzo floors and perform other work required in helping a terrazzo craftsman. The terrazzo worker generally supervises mixing of the top course that, along with the grinding, governs its final appearance.

### Where Employed

Marble setters, tilesetters, and terrazzo workers are employed mainly in new building construction and in the large urban areas. Substantial numbers of terrazzo workers are employed in Florida and California.

### Training, Other Qualifications, and Advancement

Most training authorities, including the national joint labor-management apprenticeship committees that set the training standards in these trades, recommend the completion of a 3-year apprenticeship program as the best way to learn each of these trades. A substantial proportion of tilesetters, terrazzo workers, and marble setters, however, have acquired their skills informally by working for many 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 assets. Applicants should have an eye for quickly determining proper alignments of tile, terrazzo, and marble, and have a good sense of color harmony.

The apprenticeship programs in each of these trades generally consist of 6,000 hours of on-the-job training, in addition to related classroom instruction. In a typical 3-year training program for terrazzo workers, apprentices learn, among other things, to use,

care for, and handle safely the tools, equipment, and materials commonly used in the trade; mix, place, tamp, and level terrazzo material and concrete; and select, set, and level metal dividing strips. The apprentice also learns the selection and placement of materials according to the design of the job; the rough and final finishing of bases and coves; and hand and machine rubbing.

The apprentice receives related classroom instruction in blueprint reading, layout work, basic mathematics, and shop practice.

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 apprentice training.

Skilled and experienced tile, terrazzo, or marble setters may become foremen. Others may be able to start their own small contracting businesses.

### Employment Outlook

Combined employment in the three trades—marble setter, tilesetter, and terrazzo worker—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, job opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. However, employment growth and retirements and deaths, together, will provide only several hundred job openings annually.

Total employment in these trades is expected to increase mainly because of the anticipated rapid expansion in construction activity. (See discussion, p. 321.) However, the rate of employment growth will vary sharply among these trades.

The demand for terrazzo workers is expected to increase rapidly. Because terrazzo is durable and attrac-

tive, the number of terrazzo installations is expected to continue to increase substantially. Growth of the trade also will be stimulated by the use of new terrazzo materials, especially epoxy and latex terrazzo. These products, which are lighter and take less space than cement-based terrazzo, are being used increasingly, especially on the upper floors of multi-storied buildings. A small number of skilled terrazzo workers have been recruited from abroad to meet shortages of these workers in some areas.

A moderate increase is expected in the employment of tilesetters. Growth of this trade will be limited by the increasing use of competing materials, such as asphalt floor tile, structural glass, plastic tile, and plastic-coated wallboards, which usually are installed by workers other than tilesetters.

Little change in the employment of marble setters is expected. However, the excellent properties of marble as a building material will insure its continued use and provide work for marble setters, despite the relatively higher costs of marble compared with competitive materials.

### Earnings and Working Conditions

Union minimum hourly wage rates for terrazzo workers averaged \$5.10; for marble setters, \$4.85; and for tilesetters, \$4.79; as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. These rates compared with the average of \$4.83 for all journeymen in the building trades. Among the individual cities surveyed, the minimum hourly rates for terrazzo workers ranged from \$3.55 in Tampa, Fla., to \$6.05 in Newark, N.J., and New York City. For marble setters, the hourly rates ranged from \$3.45 in Salt Lake City, Utah, to \$5.45 in New York City. The rates for tilesetters ranged from \$3.55 in Tampa, Fla., to \$5.50 in San Francisco-Oakland, Calif. Straight-time hourly earnings

(excluding fringe benefits or payments to health, insurance, or pension funds) for marble setters, tilesetters,

and terrazzo workers in 12 (of the 68) selected cities, as of July 1, 1966, were as follows:

City	Rate per hour		
	Marble setters	Tile-setters	Terrazzo workers
Atlanta.....	\$4.35	\$4.35	\$4.35
Baltimore.....	4.78	4.19	4.19
Boston.....	5.05	5.05	5.05
Chicago.....	5.15	5.05	5.00
Cleveland.....	5.03	5.14	4.81
Dallas.....	4.30	3.90	3.90
Denver.....	4.70	4.80	4.80
Detroit.....	5.55	4.82	4.92
Little Rock.....	3.80	3.80	3.80
New Orleans.....	4.23	3.70	3.70
Sacramento.....		4.92	4.85
Spokane.....	4.86	4.66	5.00

Marble setters and terrazzo workers work both indoors and outdoors, depending on the type of installation. Tilesetters work mostly indoors.

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; and International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers.

### Where To Go for More Information

For further information regarding apprenticeships or other work opportunities in these trades, inquiries should be directed to local tile, terrazzo and marble setting contractors or to locals of the unions previously mentioned. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of marble setters, tilesetters, and terrazzo workers may be obtained from:

Bricklayers, Masons and Plasterers'  
International Union of America,  
815 15th St. NW., Washington, D.C.  
20005.

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers,  
821 15th St. NW., Washington, D.C.  
20005.

National Terrazzo and Mosaic Association, Inc.,  
1901 Fort Myer Dr., Arlington, Va.  
22209.

Tile Contractors' Association of America, Inc.,  
1901 Fort Myer Dr., Arlington, Va.  
22209.

### OPERATING ENGINEERS (CONSTRUCTION MACHINERY OPERATORS)

(D.O.T. 850.782 through .887; 851.883 and .887; 852.883; 853.782 and .883; 859.782; and 859.883)

#### Nature of Work

Operating engineers operate various types of power-driven construction machinery. These machines include power shovels, cranes, derricks, hoists, pile drivers, concrete mixers, paving machines, trench excavators, bulldozers, tractors, and pumps. Operating engineers often are identified by the types of machines they operate—for example, craneman, bulldozer operator, or derrick operator.

These craftsmen have a wide range of skills because they work with many different types of machines—some complex and others relatively simple. The range of skills may be illustrated by describing the work performed by an engineer who operates a crane and one who operates 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 load-line. 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 needed to do the crane operator's job. In 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.

While the skills required of an operating engineer vary, there is an increasing trend toward more versatility in this field, and an individual who desires steady employment, particularly in the construction field, should know how to operate several different types of equipment. Operators prefer to work on the more complex types of machines, because they are paid higher wage rates for operating such machines.

#### Where Employed

An estimated 275,000 operating engineers were employed as excavating, grading, and road machinery operators in early 1967. In addition, thousands of operating engineers were employed as operators of other types

of construction machinery, including cranes, derricks, hoists, diesel engines, air-compressors, trench-pipe layers, and dredges.

The majority of operating engineers work on construction projects. Most of the construction machinery operators are employed by contractors engaged in highway, dam, airport, and other large-scale engineering projects. On building projects, they are employed in excavating, grading, landscaping and in hoisting concrete, steel, and other building materials. Others are employed by utility companies, manufacturers, and other business firms that 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 (crane-man) in a steel mill differs considerably from that of a crane operator in the construction industry.

Construction machinery operators are employed in every section of the country. Their work, however, may take them to remote locations where highways and heavy engineering projects, such as dams, are being constructed.

### **Training, Other Qualifications, and Advancement**

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for Operating Engineers,

recommend the completion of a 3-year apprenticeship as the best way to qualify for journeyman status as an operating engineer. Many men with mechanical aptitude, however, enter this occupation by obtaining jobs as oilers (operating engineer's assistants) or as helpers to heavy equipment repairmen. Workers on these jobs gain a knowledge of the machinery, how to keep it in good working order, and how to make repairs. Oilers and helpers must perform their work well and demonstrate initiative before they are given the instruction from experienced operators that is necessary for advancement. They also must demonstrate interest in and ability to learn the correct methods of handling equipment, and be able to recognize hazards that must be avoided.

Some men with mechanical experience, such as that obtained from operating farm equipment, may get jobs operating the simpler construction machines. Operating knowledge of a

broad range of related equipment and attachments, however, is ordinarily necessary to obtain continuous employment. This all-round knowledge is obtained best through a formal apprenticeship program or by working as an oiler or helper, usually for a much longer period of time than it takes to complete an apprenticeship.

Apprenticeship standards provide training in the operation of each of the following types of equipment: (1) Universal equipment (hoists, shovels, cranes, and related equipment), (2) grading and paving equipment, and (3) plant equipment (such as material mixing and crushing machines). These standards also provide for the training of heavy-duty construction machinery repairmen. The apprenticeship program for each training classification consists of at least 6,000 hours (3 years) of on-the-job training. Training is given either by a lead engineer, a journeyman, or a master mechanic. In a typical universal equipment training program,



the apprentice learns, among other things, to use, care for, and handle safely the equipment and tools used in the trade; set grade stakes; and read plans and instructions. He also learns to use welding and cutting equipment and the different types of greases and oils. In addition to on-the-job training, the apprenticeship program includes a minimum of 144 hours a year of related classroom instruction in subjects such as blueprint reading, elements of electricity, physics, welding, and automotive servicing.

Apprenticeship applicants generally must be between the ages of 18 and 25 and must be physically able to perform the work of the trade. A high school education or its equivalent is required to complete satisfactorily the related theoretical instruction. Applicants must demonstrate also the ability and aptitude necessary to master the rudiments of the trade.

Hourly wage rates for apprentices start at a stipulated proportion of the journeyman rate (at least 65 percent in most cases) and increase periodically until the journeyman rate is reached at the completion of the apprenticeship.

### Employment Outlook

Employment of construction machinery operators is expected to increase rapidly through the 1970's, assuming relatively full employment nationally and the high level of economic activity needed to achieve this goal. Thousands of additional job opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to provide more than 4,000 job openings annually.

The rapid rise in employment of operating engineers will occur mainly because of the anticipated growth in construction activity. (See discussion, p. 321.) The growing volume of highway construction resulting from the Federal Government's long-range, multibillion dollar highway develop-

ment program, will be especially important in providing thousands of job opportunities for operating engineers. Job opportunities also will result from the need to maintain and repair the Nation's expanding highway system.

The trend toward the increasing use of construction machinery shows every indication of continuing. More specialized and more complex machines, particularly those used in earth-moving, as well as smaller machines suitable for small construction projects, are being developed continually and are expected to be used to a greater extent. The increasing mechanization of materials movement in factories and mines also should result in growing employment of operating engineers outside of construction.

Technological improvements are expected to limit somewhat the growth in employment of construction machinery operators. For example, the increased size, speed, mobility, and durability of construction machines has expanded operators' work efficiency. Mobile truck cranes are now in use that can lift 125 tons to a height of 330 feet (equivalent to a 33-story building). These mobile cranes can travel over highways at speeds up to 35 m.p.h. Scrapers are in use that can scoop up and carry from 75 to 150 tons of dirt in one load. Earth moving machines now move many times the amount of material that could be moved by the largest machine in use a few years ago. Redesign of equipment has reduced breakdowns and improved maintenance efficiency.

In addition to improvements in conventional machinery, many types of laborsaving equipment developed in recent years are expected to gain widespread use in the next decade. Frequently, these machines combine the functions of several conventional machines. One example is the slip-form paver that spreads, vibrates, forms, and finishes concrete paving in one continuous operation. The slip-form paver replaces at least four other machines formerly used in concrete

paving. A pipelaying machine digs a trench, lowers the pipe into the trench, and fills the trench after the pipes are connected. In addition, electronic controls on construction equipment are being used increasingly. For example, the use of electronic grade controls on highway paving equipment results in smoother pavements and greater efficiency of the paving operation.

### 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 operators of different types of machines, but also for operators of 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.

Shovel operators, who generally are among the highest paid construction machinery operators, had union minimum hourly rates ranging from \$3.90 in Birmingham, Ala., and Norfolk and Richmond, Va., to \$6.90 in Newark and Trenton, N.J., as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. The rates for bulldozer operators ranged from \$3.25 in Norfolk and Richmond, Va., to \$5.63 in New York City.

The operating engineer's work is performed outdoors; consequently, he usually works steadily during the warmer months and may experience slow periods during the colder months. The work is active and sometimes strenuous. The operation of some machines, particularly bulldozers and some types of scrapers, is physically tiring because the constant movement of the machine shakes or jolts the operator.

A large proportion of operating engineers are members of the International Union of Operating Engineers.

### Where To Go for More Information

For further information regarding operating engineer apprenticeships or other work opportunities in this occupation, inquiries should be directed to local general contractors; a local of the International Union of Operating Engineers; a local joint apprenticeship committee; or the nearest office of the State Apprenticeship Committee or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of operating engineers may be obtained from:

Associated General Contractors of America, Inc.,  
1957 E St. NW., Washington, D.C.  
20006.

International Union of Operating Engineers,  
1125 17th St. NW., Washington, D.C.  
20036.

### PAINTERS AND PAPERHANGERS

(D.O.T. 840.131, .381, .781, .884, and .887 and 841.781)

#### Nature of Work

Painting and paperhanging are separate skilled building trades, although many craftsmen in these trades do both types of work. Painters prepare the surfaces of buildings and other structures and then apply paint, varnish, enamel, lacquer, and similar materials to these surfaces. Paper-

hangers cover room interiors with paper, fabric, vinyls, or other materials.

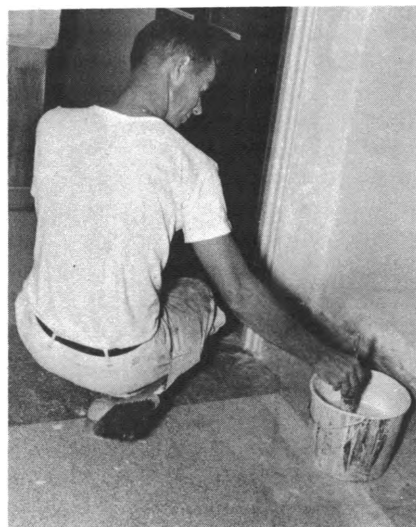
One of the primary duties of the painter—especially in repainting—is to prepare the surface. Loose paint must be removed by scraping or by heating with a blowtorch and then scraping. Grease must be removed, nail holes and cracks filled, rough spots sandpapered, and dust brushed off. Usually, new surfaces must be covered with a prime coat or sealer to provide a suitable surface or base on which to apply fresh paint. Paint is applied to many kinds of materials, including wood, structural steel, and clay products, generally by 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. He must be able to mix paints, match colors, and must have a knowledge of paint composition and color harmony. He also must 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.

Painters must know how to erect the scaffolding from which they often work, including "swing stages" (scaffolds suspended by ropes or cables attached to roof hooks) and "bosun chairs," which they use when working on tall buildings and other structures.

Painters often use spray guns to paint surfaces or objects that are difficult to paint with a brush, such as lattices, cinder and concrete block, and metal fencing. They also use spray guns on large areas that 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.

The paperhanger first prepares the surface to be covered. In new work, he applies "sizing," a prepared material that makes the plaster less porous and assures better sticking of the paper to the surface. In redecorating work, it may be necessary to remove old paper by soaking or, if there are



many layers, by steaming. Frequently, it is also necessary for paperhangers to do minor plaster patching in order to get a smooth base for the covering material.

When the wall has been prepared, the paperhanger measures the area to be covered. He cuts a length from the roll of wallpaper (paper usually comes in standard widths of 24 to 30 inches), taking care that patterns will match at the ceiling and baseboard. He mixes a paste and applies it to the reverse side of the paper. The paste-coated paper strip is then placed on the wall (or ceiling) and smoothed into place with the hand and a dry brush. The paperhanger takes care to remove air bubbles by smoothing toward the outer edges. In this final step, the craftsman matches the adjacent edges of the patterned paper, cuts and fits the horizontal edges at the ceiling and/or base, smooths the seams between strips with a roller or other special tool and, finally, makes a thorough inspection for air bubbles and other imperfections in the work. Then he is ready to place the next wallpaper strip. When working with wall coverings other than paper, the paperhanger follows the same general procedure.

#### Where Employed

Most painters and paperhangers work for contractors engaged in new



Paperhanger removes excess wall covering around window frame.

construction activity. Substantial numbers of painters and paperhangers also are employed by contractors to do repair, alteration, or modernization work. Hotels, office buildings, shipyards, 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, as in hotels or apartment buildings, maintenance painters may also do the paperhanging.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Painting and Decorating Apprenticeship and Training Committee recommend the completion of a 3-year formal apprenticeship as the best way to become a journeyman painter or paperhanger. A substantial proportion of painters and paperhangers, however, have learned the trade informally, by working for many 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 generally are required to be between the ages of 16 and 25 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 other materials used in these trades, such as varnish, turpentine, and lacquer.

The apprenticeship for painters and paperhangers generally consists of 6,000 hours (3 years) of on-the-job training, in addition to 144 hours a year of related classroom instruction. Many apprenticeships combine painting and paperhanging. In a typical 3-year training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; prepare surfaces, including sizing, sandpapering, and patching walls; match and mix colors; apply various types of interior and exterior materials, including stain, lacquer, enamel, oil, and varnish; and erect scaffolding.

In addition, the apprentice receives related classroom instruction in color harmony; paint chemistry; estimating costs; and 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 usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate of pay is reached upon completion of apprenticeship.

Painters and paperhangers may advance to foreman. They also may advance to jobs as estimators for painting and decorating contractors—computing material requirements and labor costs. Some may become superintendents on large contract painting jobs, or they may estab-

lish their own businesses as painting and decorating contractors.

### Employment Outlook

Employment of painters—estimated at about 460,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition to employment growth, thousands of job openings will arise from the need to replace experienced painters who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide more than 12,000 job openings annually.

The large rise anticipated in construction activity (see discussion, p. 321) is expected to result in a growing demand for painters. Moreover, recently developed paints, such as polyester and vinyl coatings and epoxys, that are heat-, abrasion-, and corrosion-resistant have resulted in new uses for paints and additional job opportunities for painters. Furthermore, a growing number of painters are expected to be needed in the maintenance departments of large industrial and commercial firms.

Technological developments are expected to limit the employment of painters. New types of paint that are more easily applied and have improved "covering power" have made it easier for inexperienced workers to do work that is acceptable to some customers. Other paints that are being introduced promise to double the "life" of ordinary paints. Spray painting requires fewer painters to do the same amount of work. In addition, many items formerly painted at the building site now come from a factory 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.

Employment of paperhangers—estimated at about 12,000 in early 1967—is expected to increase by a

few thousand through the 1970's. In addition, some job openings will result from the need to replace experienced paperhangers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to result in more than 500 job openings annually.

Growth in the employment of paperhangers is expected mainly because of the anticipated increase in construction activity. Also, the more widespread use of fabric, plastic, and other types of wall coverings should contribute to the demand for these workers. However, the use of paints for interior walls as well as wallpapers designed for easier application by "do-it-yourselfers" will tend to limit the employment growth of paperhangers.

### Earnings and Working Conditions

Union minimum hourly wage rates for painters and paperhangers in 68 large cities averaged \$4.46 and \$4.37, respectively, as of July 1, 1966, according to a national survey of building trades workers. In comparison, the average rate for all journeymen in the building trades was \$4.83 an hour. Among individual cities surveyed the minimum hourly rates for painters ranged from \$2.90 in Richmond, Va., to \$4.97 in Sacramento, San Diego, and San Francisco-Oakland, Calif. The rates for paperhangers ranged from \$2.90 in Richmond, Va., to \$5.25 in Trenton, N.J.

Painters and paperhangers often are 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.

A large proportion of painters and paperhangers are members of the Brotherhood of Painters, Decorators and Paperhangers of America. A few are members of other unions.

### Where To Go for More Information

For further information regarding painting and paperhanging apprenticeships or other work opportunities in these trades, inquiries should be directed to local painting and decorating contractors; a local of the Brotherhood of Painters, Decorators and Paperhangers of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of painters and paperhangers may be obtained from:

Brotherhood of Painters, Decorators and Paperhangers of America,  
1925 K St. NW., Washington, D.C.  
20006.

Painting and Decorating Contractors Association of America,  
2625 West Peterson Ave., Chicago,  
Ill. 60605.

### PLASTERERS

(D.O.T. 842.381 and .781)

#### Nature of Work

The plasterer is the building craftsman who applies a plaster coating to interior walls and ceilings to form fire-resistant and relatively sound-proof surfaces, which may then be decorated with paint or wallpaper covering. They also apply more durable cement plaster or stucco to exterior walls, and form and cast ornamental designs in plaster.

In interior work, three distinct coats of plaster—scratch, brown, and finish (usually white as described be-

low), are usually applied to ceilings and walls. On wire or metal lath, the initial or scratch coat is applied directly to the lath (backing to which plaster readily adheres), scarified before set with a special tool, and then allowed to set for a day or more before applying the brown coat, or second layer of plaster. On gypsum lath or masonry walls, the same procedure may be used; however, the brown coat can usually be applied immediately after the scratch coat has been completed.

The plasterer uses a hawk (a square plate of lightweight metal, with a handle, about 14 by 14 inches), which holds several trowelfuls of material, and a trowel to apply the wet material. While applying the brown coat, the plasterer plumbs and straightens corners, angles, and wall and ceiling surfaces using a straight-edge or beveledge. The craftsman then uses a darby (a wood or metal float, with handles, about 4 inches wide and 42 inches in length) to bring the main body of the walls and ceiling to a smooth and uniform finish. The brown coat is allowed to start its initial set and is then floated (rubbed lightly using a circular motion) using a wood hand float with slightly protruding nails. The nails scratch the undercoat which, in turn,



Plasterers patch surfaces around added doorway.

leaves the undercoat coarse and provides greater adhesion for the final finish coat.

Before applying the finish coat, the brown coat must dry for several days. During cold weather, heat may be necessary to prevent the freezing and failure of materials, and aid the drying process of the plaster. When the brown-coated walls are considered ready for the final coat by the plasterer, the white coat (slaked lime, plaster of paris, water, and a retarding agent) is gaged (mixed) on a plaster board by the craftsman. The plasterer gages only enough white coat to cover an area in which he can apply a proper finish. The white coat is a relatively thin covering, must be applied carefully and quickly, and finished smooth with trowel, brush, and water before the mixture sets. The white coat sets very quickly and, in a few days, dries to a very durable and hard finish.

Plaster wall surfaces may be finished in a number of ways, by using different tools, methods, or materials. Instead of a white coat as described above, there are a variety of decorative textures, such as stipple (dots), swirl, and sand finishes.

A plasterer can do more complex types of plastering work, such as decorative and ornamental plastering. For example, he may be called upon to mold or form intricate ornamental designs such as cornices, paneling, or recesses for indirect lighting. Plasterers who do this type of work must be able to follow blueprints and other specifications furnished by the architect.

In exterior stucco work, the plasterer applies a mixture of portland cement and sand to masonry, expanded metal, or metal wire lath in the same manner as in interior plastering. The finish coat usually consists of a mixture of white cement and sand or a patented finish material, which may be applied in a variety of colors and textures.

Apprentices work with journeymen plasterers so that they may acquire a full knowledge of the craft and develop the necessary skills. Laborers

(hod carriers) mix base coat materials and some finish materials and carry them to the plasterer; they also erect scaffolding when needed.

In recent years, plasterers have been making increasing use of machines that spray plaster on walls, ceilings, and structural sections of buildings. These machines are particularly desirable when used to apply the newly developed lightweight plasters. Machines used to mix plaster have been in general use for many years.

### Where Employed

Most plasterers work 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 small amount of work for plasterers in the repair and maintenance of older buildings.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Plastering Industry Joint (labor-management) Apprenticeship and Training Committee, recommend completion of a 3- or 4-year apprenticeship as the best way to learn plastering. However, many workers in this trade have acquired some plastering skills by working for many 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 17 and 25, but this requirement may be waived for veterans. Good physical condition and manual dexterity are important assets.

Apprenticeship programs generally consist of 6,000 to 8,000 hours (3 or 4 years) of on-the-job training, in addition to at least 144 hours of related classroom instruction annually. In a typical 4-year training program, the apprentice learns, among other things, to use and handle the tools of the trade, and the properties and appropriate handling of the different kinds of materials and mixtures used in plastering. In addition, he learns how to apply scratch (first) coat and brown (second) coat; align walls and beams to given measurements; apply white coat and sand finish; install acoustical plaster and stucco, and acoustical tile, cork, and similar materials; use machines to apply and finish plaster; and lay out arches and ceilings. He also learns texture finishing.

The apprentice receives classroom instruction in such subjects as drafting, blueprint reading, and mathematics applicable to layout work. In the classroom and on the job, the apprentice becomes familiar with the work of other trades so that he may determine, for example, whether lathing or other preparatory work is satisfactory.

Plasterers may advance to foreman, superintendent, or estimator for a plastering contractor. Many plasterers are self-employed, and may employ other plasterers.

### Employment Outlook

A moderate increase in the employment of plasterers—estimated at about 50,000 in early 1967—is expected for the remainder of this decade and during the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, the need to replace experienced plasterers who transfer to

other fields of work or who retire or die will provide many job openings for new workers. Retirements and deaths alone are expected to result in slightly less than 1,000 job openings annually.

The growth in employment of these workers will result primarily from the anticipated large increase in construction activity. (See discussion, p. 321.) 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 growing use of curved surfaces and ceilings made of plaster, both as a form of architectural treatment and to achieve special lighting and acoustical effects. Machine plastering and fireproofing have become widespread. Still other developments are the increasing use of "plaster veneer" or "high density" plaster, a thin, extremely hard material used to create a finished surface, and "marblecrete," a type of stucco in which varicolored marble chips have been imbedded.

The growth in employment resulting from these favorable developments will be limited by the continuing use of nonplaster (dry-wall) construction, which can be installed by craftsmen other than plasterers.

### Earnings and Working Conditions

Hourly pay rates for plasterers rank among the highest in the skilled building trades. Union minimum hourly rates for plasterers averaged \$4.89, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 cities. Among individual cities surveyed, the minimum hourly rates for plasterers ranged

from \$3.75 in Jackson, Miss., to \$5.75 in New York City.

Plastering requires considerable standing, stooping, and lifting. Plasterers work both outdoors, doing stucco work, and indoors, plastering walls and ceilings and forming and casting ornamental designs.

A large proportion of plasterers are members of unions. They are represented by either the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers' International Union of America.

### Where To Go for More Information

For further information regarding plastering apprenticeships or other work opportunities in the trade, inquiries should be directed to local plastering contractors; locals of the unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of plasterers may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

Contracting Plasterers' and Lathers' International Association, 304 Landmark Bldg., 1343 H St. NW., Washington, D.C. 20005.

National Bureau for Lathing and Plastering, 938 K St. NW., Washington, D.C. 20001.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

## PLUMBERS AND PIPEFITTERS

(D.O.T. 862.381)

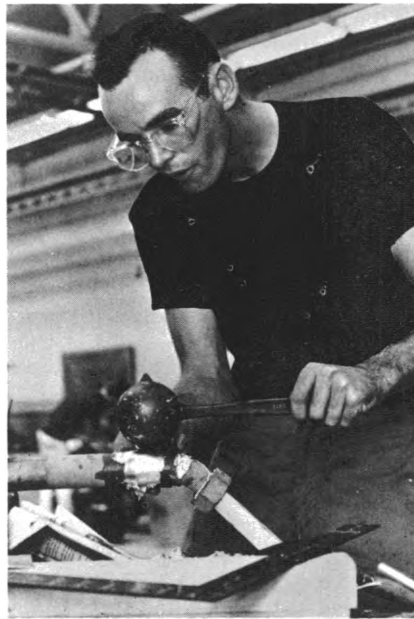
### Nature of Work

Plumbers and pipefitters are craftsmen who install pipe systems that carry water, steam, air, or other liquids or gases needed for sanitation, industrial production, or other uses. They also alter and repair existing pipe systems and install plumbing fixtures, appliances, and heating and refrigerating units.

Although plumbing and pipefitting are sometimes considered to be a single trade, journeymen in this field can specialize in either one craft or the other, particularly in large cities. Water, gas, and waste disposal systems, especially those connected to public utility systems, are installed by plumbers. Such installations are made in residential and commercial buildings, schools, industrial plants, and other structures. Pipefitters install both high- and low-pressure pipes that carry hot water, steam, and other liquids and gases, especially those in industrial and commercial buildings and defense establishments such as missile launching and testing sites. Pipefitters, for example, install ammonia-carrying pipelines in refrigeration plants, complex pipe systems in oil refineries and chemical and food-processing plants, and pipelines for carrying compressed air and industrial gases in many types of industrial establishments.

Some plumbers and pipefitters specialize in either gas fitting or steam fitting. Gas fitters install and maintain the gas fittings and the central gas main extensions that connect the main gas line with those leading to homes. Steamfitters assemble and install steam or hot water systems for commercial and industrial uses.

Plumbers and pipefitters use a variety of skills when installing pipe systems. For example, they bend pipe



Plumber connects pipe to fitting by forming solder joint.

and make welded, brazed, caked, soldered, or threaded joints. After a pipe system is installed, the plumber or pipefitter tests for leaks by filling the pipes with liquid or gas under pressure.

Plumbers and pipefitters use wrenches, reamers, drills, braces and bits, hammers, chisels, saws, and other handtools. Power machines often are used to cut, bend, and thread pipes. Hand-operated hydraulic pipe benders are also used. In addition, plumbers and pipefitters use gas or acetylene torches and welding, soldering, and brazing equipment in their work.

### Where Employed

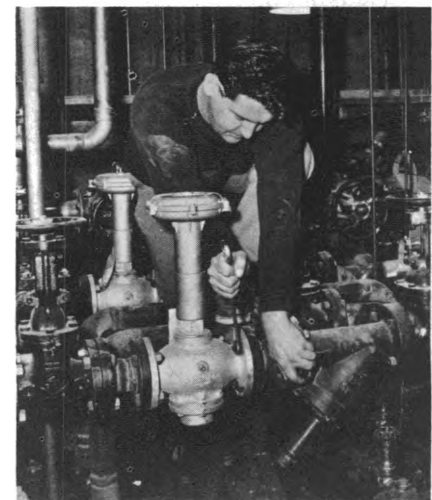
Most plumbers and pipefitters are employed by plumbing and pipefitting contractors in new construction activity, mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of

ships and aircraft. Others do maintenance work 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.

### Training, Other Qualifications, and Advancement

Most training authorities, including the national joint labor-management apprenticeship committees for the plumbing and pipefitting industries, recommend a formal 5-year apprenticeship for plumbers or for pipefitters as the best way to learn all the aspects of these trades. A large number of plumbers and pipefitters, however, have acquired plumbing and pipefitting skills informally, by working for several years with craftsmen, receiving instruction from them and watching them work. Many of these persons have gained some of their knowledge of their trade by taking trade or correspondence school 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,



Pipefitter installs valve.

is generally recommended. Applicants often are required to take aptitude tests, particularly to determine whether they have the high degree of mechanical aptitude required in this field.

Most apprentice training programs for plumbers and pipefitters are conducted under written agreements between the apprentices and local joint apprenticeship committees, composed of union and management representatives, who 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.

The apprenticeship program for plumbers or for pipefitters usually consists of 10,000 hours of on-the-job training, in addition to at least 144 hours of related classroom instruction annually. In a typical 5-year training program, the plumber or pipefitter apprentice learns, among other things, how to use, care for, and handle safely the tools, machines, equipment, and materials used in the trades. They also learn welding and soldering techniques and general repair work; the use of ladders and the erection and dismantling of scaffolding; and the proper use of plastic and glass piping. The plumber apprenticeship program includes training in the basic skills of the trade and in the installation of sewers, drains, and services outside the building; private water supply and drainage systems; building water supply systems; building drainage and vent systems; water heaters and treatment equipment; appliances; the testing, repair, and maintenance of these systems and equipment; and in estimating the materials required. The pipefitter apprenticeship program includes training in the installation and maintenance of radiators, pumps, boilers, stokers, oil burners, and gas furnaces; hot water, steam panel, and radiant-heating systems; air-conditioning and

powerplant piping systems; and pneumatic control systems and instrumentation.

The apprentice receives related classroom instruction in subjects such as drafting and blueprint reading, mathematics applicable to layout work, applied physics and chemistry, and local building codes and regulations that apply to the trade.

Hourly wage rates of apprentices in these trades usually start at 40–50 percent of the journeyman rate and increase in each 6-month period until a rate of 85–90 percent is reached during the last period of the apprenticeship.

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 plumbing or pipefitting contractors. Many journeymen go into business for themselves. As they expand their activities, they may employ other workers and become plumbing and pipefitting contractors. In most localities, contractors are required to obtain a master plumber's license.

### Employment Outlook

Employment of plumbers and pipefitters—who numbered about 350,000 in early 1967—is expected to rise moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, thousands of job opportunities will arise as a result of the need to replace experienced plumbers and pipefitters who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in about 7,000 job openings annually.

The most important factor that will contribute to the projected rise in employment is the anticipated large increase in construction activity. (See

discussion, p. 321.) Furthermore, plumbing and heating work is expected to become more important in many types of construction. For example, the trend toward more bathrooms per dwelling unit is likely to continue. The installation of appliances such as washing machines and waste disposals will become more widespread. The number of automatic heating system installations probably will increase. Also, in industry generally, pipework is becoming more important and plumbers and pipefitters will be needed for installation and maintenance work. For example, the chemical industry, which uses extensive pipework in its processing activities, is expected to expand its facilities. Those industries that 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 also will result in more work for plumbers and pipefitters.

Technological developments are expected to limit the growth in the number of jobs for plumbers and pipefitters. For example, prefabricated plumbing assemblies can now be installed as a unit, thereby reducing the amount of on-site plumbing required. Packaged gas vents are also available. Ventpipe sections come in standardized lengths that can be fastened together by locking joint bands, thus eliminating cementing operations. Some builders are preassembling their own waste, vent, and other systems components. This work—usually performed by the employers' regular crew in well-equipped shops set up near the building site—can be performed during period of inclement weather, or other "slow" periods.

### Earnings and Working Conditions

Union minimum hourly wage rates for plumbers and for pipefitters averaged \$5.08 and \$5.05, respectively, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. At the same time,

the average hourly rate for all journeymen in the building trades was \$4.83. Among individual cities surveyed, the union minimum hourly wage rates for plumbers ranged from \$3.90 in Charlotte, N.C., to \$6.56 in San Francisco, Calif.; pipefitters' rates ranged from \$3.90 in Charlotte, N.C., to \$6.85 in Oakland, Calif. Annual earnings of workers in this field 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 work of plumbers and pipefitters is active and sometimes strenuous, as is the work in the other building trades. They frequently must stand for prolonged periods and occasionally work in cramped or uncomfortable positions because much of their work is done in relatively inaccessible places.

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 has been lower than that for contract construction as a whole, but higher than the average for production workers in manufacturing industries.

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 United States and Canada.

### Where To Go for More Information

For further information regarding plumber or pipefitter apprenticeships or work opportunities in these trades, inquiries should be directed to local plumbing, heating, and air-conditioning contractors; a local union of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; a local joint union-management apprenticeship

committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

General information about the work of plumbers and pipefitters may be obtained from:

National Association of Plumbing-Heating-Cooling Contractors,  
1016 20th St. NW., Washington, D.C. 20036.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada,  
901 Massachusetts Ave. NW., Washington, D.C. 20001.

## ROOFERS

(D.O.T. 804.281; 843.844; and 866.381)

### 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 or tar impregnated felt over the entire surface. He then applies a coating of coal tar pitch, asphalt, or other bituminous material. This process is repeated until at least three layers of felt are in place. Finally, he applies a surfacing of coal tar pitch or asphalt and gravel or a smooth surface asphalt, to protect the roofing materials from the weather.

In applying other types of composition roofing, such as roll roofing and asphalt shingles, 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 felt or metal) wherever two roof surfaces intersect. Flashing is installed to make the intersections (joints) watertight.

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 wood sheathing. He punches holes in the slate or tile that he nails to the sheathing. Each row of slate or tile is placed to overlap the preceding row. Finally, the roofer covers the exposed nailheads with roofing cement to avoid rusting and water leakage around the nailheads. Handtools usually 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 or 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, or rubbing brick. He then applies a coat of liquid compound with a brush. He also may paint or spray surfaces with a waterproofing 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 avoid the penetration of moisture.

### Where Employed

Roofers work for roofing contractors on new building construction. They also do maintenance and repair work, especially on composition roofing. A few roofers are self-employed, doing either roofing on small, new building work or repairs and altera-

tions. Roofers also work for government agencies or business establishments that do their own construction and repair work.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for the Roofing Industry, recommend completion of a 3-year apprenticeship program, covering all types of roofing work, as the superior way to learn this trade. A substantial proportion of workers,

however, have acquired roofing skills informally, by working for many years as helpers or handymen, observing or being taught by experienced roofers.

Apprenticeship applicants are required to be at least 18 and not over 30 years of age; however, exceptions may be made for veterans. A high school education or its equivalent is desirable. Good physical condition and a good sense of balance are important assets.

The 3-year apprenticeship program generally consists of a minimum of 1,400 hours of on-the-job training annually, in addition to related classroom instruction. In a typical training program, the apprentice learns,

among other things, to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; work with composition, tar, and asphalt; prepare roof surfaces for covering; apply pitch and other materials; spread gravel; install slate, tile, and terra cotta; and damp-proof and waterproof work.

The trainee receives related classroom instruction in such subjects as blueprint reading and mathematics applicable to layout work.

Hourly wage rates for apprentices usually start at 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.

Roofers may advance to foreman and to superintendent for a roofing contractor. Also, they may enter business for themselves, and hire other roofers.

### Employment Outlook

Employment of roofers—who numbered nearly 60,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, thousands of job opportunities will result from the need to replace workers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to result in more than 800 job openings annually.

Employment of roofers is expected to increase mainly because of the anticipated rapid increase in construction activity. (See discussion, p. 321.) New construction and repairs on existing structures will provide most of the work for these craftsmen. However, dampproofing and waterproofing are expected to provide an increasing proportion of roofers' work.

Although the projected increase in construction activity will result in rising employment of roofers, employment growth will be limited by the



Roofers apply tar prior to spreading gravel.

increasing use of spray-on or fluid roofing systems; improved roofing materials and roofing techniques that increase the "life" of roofs; improved tools, such as nailing machines; and more efficient materials handling equipment.

### Earnings and Working Conditions

Union minimum hourly wage rates for composition roofers averaged \$4.54, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. For slate and tile roofers, the rate was \$4.37. By comparison, the average for all journeymen in the building trades was \$4.83 an hour. Among individual cities surveyed, the minimum hourly rates for composition roofers ranged from \$2.25 in Norfolk, Va., to \$5.50 in New York City. Slate and tile roofers had hourly rates ranging from \$2.25 in Norfolk, Va., to \$5.72 in New York City.

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. Roofing work may be especially hot during the warmer months.

A large proportion of roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association.

### Where To Go for More Information

For further information concerning roofing apprenticeships or other work opportunities in this trade, inquiries should be directed to local roofing contractors; a local of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or

the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other training opportunities.

General information about the work of roofers, may be obtained from:

National Roofing Contractors Association,  
300 West Washington St., Chicago,  
Ill. 60606.

United Slate, Tile and Composition  
Roofers, Damp and Waterproof  
Workers Association,  
1125 17th St. NW., Washington,  
D.C. 20036.

## SHEET-METAL WORKERS

(D.O.T. 804.281 and .884)

### Nature of Work

Sheet-metal workers engaged in construction-related work fabricate and install ducts that 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, partitions, store fronts, and metal framework for neon signs. Skilled construction sheet-metal workers should not be confused with assemblyline factory operatives who also make sheet-metal products, but can perform only a few specific operations.

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. Sheet-metal workers cut the metal with hand snips, power-driven shears, and other cutting tools. They work the metal with a variety of machines, hammers, and anvils; then weld, bolt, rivet,

solder, or cement the seams and joints. However, factory fabricated ducts in standard sizes are often available and these require little additional fabrication by sheet-metal workers. Some duct fabrication is done at the work site. In the installation of ducts, the components are fitted together. Hangers and braces are installed to support ducts, and joints may be soldered, connected, or welded. 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 firms that fabricate and install 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 work. Many of these craftsmen work for government agencies or business establishments that do their own construction and alteration work. Others are self-employed, mainly on repair work or on smaller types of installations.

In addition to sheet-metal workers who perform construction-related work, there are thousands of skilled sheet-metal workers employed in non-construction industries; for example, the railroad, aircraft, or shipbuilding industries. Some are employed in small shops manufacturing specialty products, such as custom kitchen equipment for hotels and restaurants. Firms making blowers, exhausts, electrical generating and distributing equipment, food products machinery, steam engines, and turbines also employ skilled sheet-metal workers.

### Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-man-

agement) Apprenticeship and Training Committee for the Sheet Metal Industry, recommend the completion of a 4-year apprenticeship program as the best way to learn the sheet-metal trade. Some sheet-metal workers, however, have acquired skills of the trade informally, by working for many 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 23, but special consideration may be given for military service. A high school education or its equivalent is required. Good physical and mechanical aptitude are necessary assets.

The apprenticeship program usually consists of 8,000 hours (4 years) of on-the-job training, in addition to related classroom instruction. In a typical training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade. Also, he learns how to do welding, soldering, and seaming; air-conditioning, heating, and ventilating work; residential installations such as roofing, gutters, and downspouts; and architectural and industrial sheet-metal work. In addition, he learns general work processes such as cutting, forming, folding, grooving metal material, bending edges, and punching and drilling holes.

The trainee 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 45 percent of the journeyman rate and increase periodically until 80 percent of the journeyman rate is reached during the final portion of the training period.

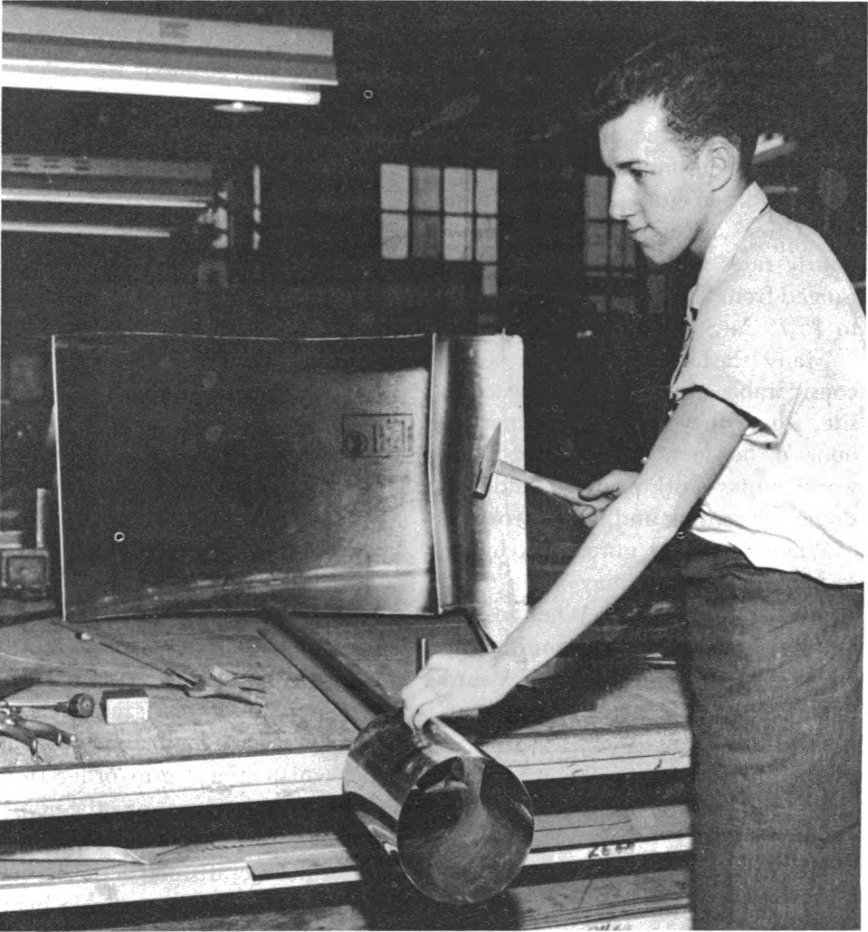
Sheet-metal workers in the construction industry may advance to foreman, superintendent of large projects, or go into business for themselves as sheet-metal contractors and hire other sheet-metal workers. Experienced workers in this trade have more job mobility than many other building trades workers because they can transfer their skills to nonconstruction industries.

**Employment Outlook**

Employment of sheet-metal workers—who numbered nearly 55,000 in early 1967—is expected to increase moderately through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, thousands of job

opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in more than 800 job openings annually.

The projected increase in employment of sheet-metal workers is expected mainly because of the anticipated large expansion in residential, commercial, and industrial construction. (See discussion, p. 321.) In addition, year-round, central air-conditioning systems are expected to be installed in a greater number of homes, office buildings, schools, hospitals, department stores, and factories. Many of these installations will be in existing structures. Sheet-metal work should also result from growth in the number of large refrigeration systems. Such equipment will be needed in the production and storage of growing



Sheet-metal worker fabricates duct at workbench.

quantities of food and other perishable items required by an expanding population. The shops that fabricate sheet-metal products used in construction are also expected to require more of these skilled craftsmen.

Prefabrication is not likely to affect the growth of employment in this occupation as much as in most other building trades, because much sheet-metal work is custom made. The fabrication 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 also by the cost of storage space needed to store prefabricated ducts and fittings.

### Earnings and Working Conditions

Union minimum hourly wage rates for sheet-metal workers averaged \$4.89, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for sheet-metal workers ranged from \$3.75 in Charlotte, N.C., to \$5.75 in San Diego, Calif.

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.

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association.

### Where To Go for More Information

For further information regarding sheet-metal apprenticeships or other work opportunities in this trade, inquiries should be directed to local sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the Sheet Metal Workers' International Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of sheet-metal workers may be obtained from:

Sheet Metal and Air Conditioning Contractors' National Association, Inc.,  
107 Center St., Elgin, Ill. 60120.

Sheet Metal Workers' International Association,  
1000 Connecticut Ave. NW., Washington, D.C. 20036.

## STONEMASONS

(D.O.T. 861.131 and .781)

### 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, limestone, or sandstone; and artificial stone, which is made to order from cement, marble chips, or other types of masonry materials. Much of the work of these craftsmen is the setting of cut stone for comparatively high-cost buildings, such as office buildings, hotels, churches, and public buildings.

The stonemason works from a set of drawings in which each stone has been numbered for identification, except where all pieces are identical. A helper or, in some cases, a derrickman, locates the pieces needed and brings them to the mason; large 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 aligns 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, anchors, or by welding.

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. 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 in various patterns to the exterior surfaces of a building. In some sections of the country, a great deal of stone is used to veneer homes. 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 stonemason are trowels, heavy hammers, wooden or hard rubber mallets, and chisels. For rapid stone cutting, pneumatic tools are used, such as hammers, drills, and brushing tools. Special power tools are used for smoothing the surface of large stones. An abrasive saw is used for fine cutting.

### 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 that do their own construction and alteration work. Stonemasons are employed mainly in the





Stonemasons reconstruct old church.

larger urban areas. In many areas where there are no stonemasons, the work is performed by bricklayers.

### Training and Other Qualifications

Most training authorities, including the National Joint (labor-management) Bricklaying Apprenticeship Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn the stonemason's trade. A substantial proportion of stonemasons, however,

have picked up the trade by working many 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 apprentice training program for stonemasons generally requires 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. During the appren-

ticeship, the trainee learns to use, care for, and handle safely the tools, machines, and materials of the trade, and to lay out and install walls, floors, stairs, and arches. The apprenticeship program in this occupation is similar to that for bricklayer. (See discussion, pp. 325-326.)

### Employment Outlook

Little increase in the employment of stonemasons is expected through the 1970's, despite the anticipated large expansion in new building construction. (See discussion, p. 321.) Less use of stone masonry work is expected, because modern architectural design has emphasized simple lines, little ornamentation, and large window areas. Replacement needs will provide a small number of job opportunities for new workers each year.

### Earnings and Working Conditions

Union minimum hourly wage rates for stonemasons averaged \$4.89, compared with \$4.83 for all journeymen in the building trades, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for stonemasons ranged from \$4.00 in Richmond, Va., to \$6.20 in New York City.

Most stonemasonry work is done outdoors. The work of the stonemason is active and sometimes strenuous, as it involves lifting heavy materials.

A large proportion of stonemasons are members of the Bricklayers, Masons and Plasterers' International Union of America.

### Where To Go for More Information

For further information regarding apprenticeships for stonemasons or other work opportunities in this trade, inquiries should be directed to local bricklaying contractors; a local of the

Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about apprenticeship and other training opportunities.

General information about the work of stonemasons may be obtained from:

Bricklayers, Masons and Plasterers'  
International Union of America,  
815 15th St. NW., Washington, D.C.  
20005.

### **STRUCTURAL-, ORNAMENTAL-, AND REINFORCING-IRON WORKERS, RIGGERS, AND MACHINE MOVERS**

(D.O.T. 801.131, .134, .281, .381, .781, .884; 809.130, .131, .134, .380, .381, .781, .884, .887; and 869.883)

Ironworkers erect, assemble, or install fabricated metal products mainly in the construction of industrial, commercial, and large residential buildings. They also may rig heavy construction machinery (prepare the machinery for moving with the proper lines, cables, and accessories) and deliver the machinery to the new site. In addition to new construction work, ironworkers do some alteration work. For example, they may install steel stairs in, or add window guards to, existing buildings. In addition, they remodel existing structures and do repair work, such as replacement of metal bridge parts. Ironworkers include four related trades—structural-iron worker, rigger and machine mover, ornamental-iron worker, and reinforcing-iron worker (rodman). Although these are distinct trades, many craftsmen are skilled in, and do



**Structural-iron workers wrestle heavy girders into position.**

the work of, two or more of these trades.

*Structural-iron workers* (D.O.T. 809.381) erect the steel framework of bridges, buildings, and other structures including metal storage tanks and overhead crane runways that support heavy equipment. They install floor decking and the doors and frames of vaults.

In erecting a steel framework or structure, structural-iron workers push, pull, or pry fabricated steel beams and girders into their proper position in the structure while the steel parts are held by hoisting equipment. Next, they temporarily con-

nect all the steel members with bolts, accurately align the structure using plumb bobs and levels, and then fasten the pieces by welding or riveting. In the construction of a large building, ironworkers generally specialize in particular operations, such as welding or riveting. Structural-iron workers often rig, as well as erect, steel structures.

*Riggers and machine movers* (D.O.T. 869.883) set up and rig hoisting equipment for erecting and dismantling structural steel frames and for moving heavy construction machinery and equipment. In performing their work, riggers and ma-

chine movers study the size, shape, and weight of the object to be moved; choose the lines, and cables with which the object can be safely moved; and select the points of attachment that will provide a safe and secure hold on the load. Next, they attach the lifting device to both the hoisting equipment and the item to be moved, and direct the load into position by giving hand signals and other directions to the hoisting machine operator. In many instances, special rigging equipment must be built on the job to move or lift materials and machines with unusual shapes. This work requires a knowledge of both the uses and limitations of the hoisting equipment and lifting devices.

*Ornamental-iron workers* (D.O.T. 809.381) install metal stairways, catwalks, floor gratings, iron ladders (such as those used extensively in powerhouses and chemical plants), metal window sash and doors, grilles and screens (such as those used in bank tellers' compartments, and elevators), metal cabinets, and safety deposit boxes. They also install lamp-posts, gates, and fences and decorative ironwork on balconies.

In addition to iron and steel, ornamental-iron workers work with aluminum, brass, and bronze metal shapes, frames, and panels. The products which they install have usually been fabricated in a factory or a shop—for example, the recently developed curtain-wall and window-wall, and the many types and designs of ornamental and functional building facades. Ironworkers fasten these metal products to a building or other structure by bolting, or welding.

*Reinforcing-iron workers (rodmen)* (D.O.T. 801.884) set steel bars in concrete forms to reinforce 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 instruction. 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 welded wire (usually 6- by 6-inch grids). When using mesh, the rodmen measure the surface to be covered, cut and bend the mesh to the desired shape, and place the mesh over the area to be reinforced. When the concrete crew pours the slab, one rodman or more position the wire mesh in the freshly poured mixture, using a hooked rod.

### Where Employed

About 75,000 structural- and ornamental-iron workers were employed in early 1967. Thousands of additional workers were employed as riggers, machine movers, and reinforcing-iron workers.

A large proportion of these craftsmen are employed by general contractors on large building projects, 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 that do their own construction work. Few of these craftsmen are self-employed.

### Training and Other Qualifications

Most training authorities recommend the completion of a 3-year apprenticeship as the best way to learn these trades.

Apprenticeship applicants are required to be between the ages of 18 and 30. Good physical condition is required. A high school education or its equivalent is desirable.

The apprenticeship program for ironworkers usually consists of 6,000 hours (3 years) of on-the-job training. On-the-job instruction is given either by the foreman or an experienced journeyman. In a typical training program, the apprentice learns, among other things, to use, care for,

and handle safely the tools, machines, equipment, and materials commonly used in the trade; read blueprints and working drawings; form, shape, drill, tap, and erect and assemble various metal structures; lay out and assemble steel stairs, fire escapes, grilles, railings, fences, doors, and related metal structures; and erect, place, and tie reinforcing iron. He also learns arc and gas welding; acetylene cutting; rigging, bolting, and riveting; and how to repair and alter metal structures.

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.

A r e a w i d e apprenticeship programs, sometimes covering an entire State or region, are found extensively in ironworking trades. They are supervised by joint apprenticeship committees composed of representatives of the International Association of Bridge, Structural and Ornamental Iron Workers' local unions and local management groups.

Hourly wage rates for apprentices start at not less than 60 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.

### Employment Outlook

Employment in these trades is expected to increase rapidly through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. In addition, the need to replace experienced ironworkers who transfer to other occupations, retire, or die will provide a few thousand job opportunities each year. Retirement and deaths alone are expected to result in about 1,400 job openings annually.

A continued rapid rise in employment of these workers is expected



Reinforcing-iron workers (rodmen) wire steel rods in place.

principally because of the anticipated large increase in construction activity. (See discussion, p. 321.) The job outlook in these trades also will be affected favorably by the increased use of structural steel in smaller buildings. Also, the development of lightweight and specialty steels has improved the competitive position of steel as a construction material and resulted in increasing job opportunities for structural-iron workers. Work opportunities for ornamental-iron workers will result from the growing use of ornamental panels of aluminum, porcelainized steel, or other metals, which are attached to the exterior walls of large buildings; and by the use of metal frames to hold large glass in-

stallations. The demand for riggers and machine movers is expected to increase, because of the expanding use of heavy construction machinery. The use of prestressed concrete in a growing variety of structures will result in increasing job opportunities for reinforcing-iron workers.

Technological developments are expected to limit employment growth of iron workers. For example, the development of a compact squirt-welding machine has greatly reduced the time needed for field welding. Structural steel frames are being assembled on the ground and hoisted into a vertical position, thus reducing the amount of iron work required above ground. The use of prestressed steel

beams makes possible longer spans with less steel; these beams are being used increasingly in bridge construction. Also available are almost completely prefabricated, and painted, short-span bridges made of prestressed steel, which can be erected in as little as 1 day. Also, prefabricated reinforcing mats, or fabrics, are being used increasingly in concrete highway and building construction. These prefabricated mats reduce requirements for on-site rod bending, tying, and welding by reinforcing-iron workers. In addition, an increasing variety of ornamental metal products are being designed by manufacturers for more efficient on-site installation.

### Earnings and Working Conditions

Union minimum hourly wage rates for structural-iron workers and rodmen averaged \$4.97 and \$4.83, respectively, as of July 1, 1966, according to a national survey of building trades workers in 68 large cities. The average for all journeymen in the building trades surveyed was \$4.83. Among the individual cities, the minimum hourly rates for structural-iron workers ranged from \$3.95 in Lubbock, Tex., to \$6.45 in Newark, N.J. The rates for rodmen ranged from \$3.80 in Jackson, Miss., to \$6.45 in Newark, N.J. The rates for ornamental-iron workers, riggers, and machine movers are generally about the same as those for structural-iron workers. The earnings of ironworkers often are increased by considerable overtime work at premium pay.

Since the materials used in the ironworking trades are heavy and bulky, above average physical strength is necessary. Agility and a good sense of balance also are required, because some structural work is done at great heights and on narrow footings. Although many ironworkers risk injury from falls from heights, the use of safety devices, such as nets, safety belts, and scaffolding, has reduced the frequency of accidents in recent years.

Ironwork often involves considerable travel. In most localities, the demand for ironwork is insufficient to keep 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, factory building, or suspension bridge. Large contractors may keep a small crew continually employed, moving them from job to job and city to city.

A large proportion of workers in these trades are members of the Inter-

national Association of Bridge, Structural and Ornamental Iron Workers.

#### **Where To Go for More Information**

For further information concerning apprenticeships or other work opportunities in these trades, inquiries should be directed to local general contractors; a local of the International Association of Bridge, Structural and Ornamental Iron Workers; a local joint union-management apprenticeship committee; or the nearest office of the State apprentice-

ship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of ironworkers may be obtained from:

Associated General Contractors of  
America, Inc.,  
1957 E St. NW., Washington, D.C.  
20006.

## DRIVING OCCUPATIONS

More than 2 million employees were engaged in moving passengers and goods over highways and city streets in 1966. They transported thousands of products used in homes, schools, and factories, and also transported millions of people every day. In 1966, about 14 million privately owned motortrucks were registered. They were operated by stores, dairies and other farm enterprises, industrial firms, and for-hire motor carriers. In addition, Federal, State, and local governments operated about 750,000 trucks. Of the 300,000 buses registered in 1965, more than 200,000 were schoolbuses and 80,000 were commercial vehicles. Of the latter, about 50,000 were used for local transit work; 30,000 for intercity passenger traffic; and the remainder for sightseeing, charter, and other services.

Some drivers spend practically all of their working time driving. Others 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. This chapter deals only with employment opportunities for those whose principal occupation is driving intercity and local trucks and buses and taxis. For example, it does not cover schoolbus drivers, chauffeurs,

part-time taxi drivers, ambulance drivers, or employees whose driving is incidental to their regular duties.

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 supervision.

During the 1970's, employment of local and over-the-road truckdrivers is expected to expand as a result of increases in the freight moved by motor carrier. Employment in other driving jobs is not expected to change much in the years ahead. Normal turnover in this large occupational field will also provide many job opportunities each year.

Driving jobs offer excellent opportunities for young men who are not planning to attend college and who have no interest in or aptitude for craft or technical occupations. 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 and the frequent contacts with people, which are characteristic of most of these jobs.

### OVER-THE-ROAD TRUCKDRIVERS

(D.O.T. 903.883; 904.883; 905.883; and 909.883)

#### Nature of Work

The men at the wheel of the big trucks on highways and turnpikes are generally the top professional drivers. They 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. The work requires a good deal of ini-

tiative, as they must transport goods and materials of great value which must be delivered safely and on time.

Most over-the-road drivers operate gasoline or diesel powered tractor-trailers. (The tractor is the short-chassis vehicle that draws the trailer which contains the freight.) 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 line-haul or long-haul driver) spends practically all of his working time in driving. He may sometimes handle the freight. Some drivers, for example, may have to unload the goods they deliver to stores at night when receiving crews are not available. Drivers of long-distance moving vans generally have to load or unload their cargoes, with the assistance of local helpers.

The truckdriver must back up big trailers to loading platforms; this requires the ability to maneuver the trailers while driving in reverse. He must also be able to judge distance accurately while driving around corners or 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.

U.S. Department of Transportation (USDOT) regulations require drivers to inspect their trucks before and after trips and make out reports on the condition of the vehicle 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. These regulations also prescribe special safety precautions concerning

packing and loading flammable, explosive, or otherwise hazardous materials, and over-the-road driving of trucks containing these materials.

### Where Employed

About 600,000 over-the-road drivers were employed throughout the United States in 1966. Many work out of large cities such as Chicago and Los Angeles; however, some large companies have their operating headquarters in fairly small towns.

Over-the-road drivers are employed by private and for-hire carriers. Private carriers are companies, such as chain food stores or manufacturing plants, which use their own or leased 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 for certain companies). While the drivers of the big tractor-trailers on long intercity runs are more often employed by common carriers, an increasing number of drivers in recent years have been working for private or exempt (from USDT regulation) carriers, or for specialized carriers handling large pieces of machinery, explosives, or missiles. On shorter hauls, many drivers are employed by contract and common carriers to make deliveries of machinery, food, petroleum products, household appliances, and other items, from plants to warehouses and from warehouses to large volume purchasers.

### Training, Other Qualifications, and Advancement

Regulations of the USDT establish minimum qualifications for over-the-road drivers. 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 1 year's driving experience (which may include driv-

ing private automobiles) 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.

Most fleet operators have higher hiring standards than those described above. Many firms will not hire drivers under age 25; some specify height and weight limitations. Many require at least a grade school education; others require 2 years of high school. Some companies employ only applicants who have had several years of experience in handling vehicles of the type they would be required to drive.

The standards for over-the-road drivers are generally higher than those for local truckdrivers. Furthermore, these standards are more strictly adhered to than those for local drivers, whose standards may be lowered when there are not enough applicants for jobs.

The tractor-trailer often seen on highways usually costs between \$20,000 and \$25,000, and the load inside may be worth more than \$100,000. The owners of such valuable equipment, therefore, employ experienced drivers who also can accept great responsibility.

Many training authorities and employers recommend that young men interested in becoming professional drivers should begin by taking the driver-training courses offered by many high schools. If such a course is not available, the driving schools which operate in most large cities are recommended. A high school course in automotive mechanics is also helpful.

Long-haul driving is considered a senior driving job and most such drivers have had previous experience in local trucking. Usually they enter this occupation by first driving a small, light truck; then, after gaining experience, they get jobs driving the larger and more complicated trucks. A young man may also begin as a helper to a local truckdriver, assisting him in loading and unloading the

truck, and occasionally doing some relief driving.

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. Others hire on the basis of personal interviews, and have training programs consisting 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 sharpness and field of vision, reaction time, 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 few States require such a test before licensing a driver to operate a tractor-trailer combination.

A new driver may be given a brief indoctrination course covering company policy and the preparation of various forms he will use on the job. He 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.

Opportunities for promotion in this occupation are limited. A few drivers may advance to jobs as safety supervisors, driver supervisors, and dispatchers. These jobs are often unattractive to over-the-road truckdrivers since the starting pay on these

jobs is usually less than the pay on truckdriving jobs. Most drivers can only expect to advance, on the basis of seniority, to driving runs that provide increased earnings or preferred schedules and working conditions.

### Employment Outlook

The employment of over-the-road truckdrivers is expected to increase very rapidly through the 1970's. Substantial growth in the volume of intercity freight is anticipated, resulting from increased commercial and industrial activity and the continued decentralization of industry. A large number of job openings will also be created by transfers from this field of work, or to local truckdriving jobs. Approximately 12,000 additional job openings are expected each year as a result of retirements and deaths, and the number may be increased somewhat by the trend toward earlier retirements.

Freight carried by over-the-road trucks has been increasing as a result of the general economic growth of the Nation, and this trend is expected to continue. 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. The intercity highway building program has aided the trucking industry in this regard. Furthermore, the growth of chainstores, and the trend to smaller inventories and decentralization of factories require daily coordination of shipping which can best be handled by trucks.

Improvements in trailer design have also contributed to more over-the-road trucking, by making it possible to ship certain kinds of freight, such as frozen goods and livestock, for longer distances.

Demand for trucking services may increase as a result of new trucking methods which promise reduced handling and shipping time and, therefore, reduced freight costs for small loads. One example is the increasing use of "double-bottoms"—two trailers

hitched in tandem to a tractor. When two trailers (24 to 28 feet) are used, they can be unhitched at the truck terminal and promptly delivered to the customers, thus eliminating the need to unpack a larger trailer, separate its contents, and repack on local delivery trucks; on a smaller scale is the practice of packing all freight destined for a single customer or area into large containers or cargo cages which can be handled at the truck terminal more conveniently and quickly than individual packages.

Some recent freight transportation innovations will limit somewhat the anticipated increase in trucking business and driver employment. For example, the movement of highway trailers on railroad flatcars, ocean vessels, and aircraft saves the cost of driver, fuel, and tractor, and appears to have prospects for considerable expansion. To compensate for job displacement that may arise from such innovations, there is a growing practice under labor-management agreements to provide for retirement at an earlier age.

Further limitations on employment expansion among over-the-road drivers are related to changes in State laws. State limitations on truck weight, size, and speed are becoming less restrictive as a result of the construction of better highways and improved travel arteries inside the cities. 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 greatly increased over-the-road tonnage anticipated in the years ahead.

In the long run, however, the total volume of goods shipped and the convenience and mobility of motor transport are expected to be great enough to insure continued growth of driver employment in trucking.

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 may temporarily decline, over-the-road trucking is less affected than other

means of transportation. It gets a larger share of any shrinking transportation business because manufacturers and merchants who are unable to buy merchandise in railroad carload lots can reduce inventories and still maintain their diversified stock by small daily shipments by truck. Small lots are handled primarily by trucks.

### Earnings and Working Conditions

Most over-the-road drivers earned at least \$150 a week in 1966 and the majority made far more. Drivers employed by class I common carriers of general freight (carriers with gross operating revenues of \$1 million or more a year) had annual average earnings in excess of \$9,695 in 1965, the most recent year for which such data are available. Better experienced over-the-road drivers can earn \$12,000 or more a year. The rates are fairly uniform because this is a highly unionized field and union-employer contracts are generally master agreements covering all employers within a region—an area including a number of States. Furthermore, regional contracts tend to be quite uniform because drivers working under different contracts often travel the same routes. The earnings of an individual driver are affected by such factors as mileage driven, number of hours worked, type of equipment driven or the weight of the loads carried, type of "run" (whether or not pickup or delivery en route is required) and the nature of the cargo carried, with premium rates paid for transporting flammable or otherwise hazardous commodities.

Drivers on the longer runs are generally paid on a mileage basis for actual driving time. 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 owing 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 en route. Regular drivers are usually assured minimum pay for a certain number of hours—generally 8 hours a day.

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 additional hours he receives extra pay.

In recent years, more than 200,000 motortrucks were operated by regulated carriers subject to the USDT rules governing hours of work and other matters. These regulations limit the hours over-the-road drivers may work in order to be certain the driver has a reasonable amount of rest. For example, no driver may be on duty for more than 60 hours in any 7-day period, but for carriers operating every day of the week, the driver may remain on duty for a maximum of 70 hours in any period of 8 consecutive days. The regulations also provide that no driver may drive more than 10 hours without first having an off-duty period of at least 8 hours. For drivers who drive less than 10 hours, but perform other work for the motor carrier in a garage, warehouse, or other place, the regulations prohibit resumption of driving after any combination of driving time and other on-duty work which totals 15 hours, unless the driver has first had at least 8 hours off duty. Many drivers, particularly on the very long runs, work fairly close to the maximum hours permitted. A workweek of at least 50 hours is very common.

Most drivers receive pay for 6 or more national, State, and local holidays. They also have paid vacations, usually from 1 to 4 weeks, depending upon their length of service. Health insurance, and pension plans, 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. In such instances, 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. He may make two or three such round trips a week and if the trips are part of a relay operation, another driver works 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 a bunk behind the cab. The vehicle goes straight through to the end of the run where there may be a layover before the return trip. Two periods of 4 hours of resting or sleeping in a berth in the truck meet the USDT requirement of 8 hours off duty following 10 hours of driving. This means that the drivers on a run may remain with the truck in some cases for over 100 hours.

Although earnings on sleeper runs are the highest in this field of work, few drivers stay with this type of run very long. The work is very tiring and requires being away from family and friends for days and even weeks. However, many drivers go 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 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 because of intensive safety programs and drivers' skill, the accident rate in over-the-road trucking is low. Injuries occur less frequently than in other forms of motor transportation.

The physical strain of over-the-road truckdriving has been reduced by more comfortable seating, better highways, and more stringent safety regulations. 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 Broth-

erhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers of private carriers belong to unions representing the plant employees of the companies for which they work.

### Where To Go for More Information

Information on career opportunities may be obtained from:

American Trucking Associations,  
1616 P St. NW., Washington, D.C.  
20036.

### LOCAL TRUCKDRIVERS

(D.O.T. 900.883; 902.883; 903.883;  
906.883; and 909.883)

### Nature of Work

Much of the food, clothing, and other products required by consumers is transported by trucks. The men who move these goods from terminals, warehouses, mines, and factories to wholesalers, retailers, and consumers in the local area must be skilled drivers to avoid accidents on congested city streets. They must also be able to maneuver big trucks or tractor-trailers into tight parking spaces, through narrow alleys, and up to loading platforms. (Telephone linemen, repairmen, and many thousands of other workers for whom driving is incidental to their primary 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 require the operation of mechanical levers, pedals, or other equipment. If they haul heavy machinery, they operate mechanical hoists to load and unload the machines.

### Where Employed

An estimated 1.2 million workers were employed as local truckdrivers in 1966, mostly in and around large metropolitan areas. They work in all localities, however, including the smallest villages.

A large majority of local drivers work for businesses which deliver their own products and goods—such as department stores, meatpackers and other food processors, wholesale distributors, grocery chains, petroleum companies, 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 are employed by the Federal Government including, in particular, the Post Office Department, and by States and municipalities. A large number are in business for themselves.

### Training, Other Qualifications, and Advancement

Qualifications for local truckdrivers vary considerably, depending upon factors such 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, better, 2 to 4 years of high school. The applicant must be physically able to lift heavy objects and otherwise be in good health. He should have good hearing and good 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 must have 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 driving 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 to avoid accidents in congested traffic. To

demonstrate these qualifications, an applicant's driving ability will be tested, and he may have to pass a written examination as well as a general physical examination. Employers generally will check applicants for traffic and police records.

Training given to new drivers is often informal and may consist only of riding with and observing an experienced driver on the job. Additional training may be given if they are to drive a special type of truck. Some companies give a brief indoctrination course which lasts 1 or 2 days and covers general duties, the efficient operation and loading of a 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, taking over the routes of regular drivers who are ill or on vacation, or making extra trips when necessary. They receive regular assignments when openings occur.

Local truckdrivers may get jobs as dispatchers or advance to jobs as terminal managers, or supervisors, or to traffic work, i.e., planning delivery schedules. However, these jobs are relatively few. For the most part, advancement for a local truckdriver consists of earning higher hourly wages by driving heavy or special type truck loads instead of light trucks, or by transferring to over-the-road truckdriving.

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 and meet other business expenses. Truckers who own one or two vehicles continue to account for a sizable proportion of local for-hire trucking business.

### Employment Outlook

A very rapid increase in the employment of local truckdrivers is anticipated through the 1970's be-

cause of the expected increase in volume of freight. Many new workers will also be needed to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in about 20,000 job openings each year for local truckdrivers.

The rise in total business activity anticipated in the years ahead will increase the volume of freight. Since trucks carry virtually all freight for local distribution and do not compete for hauling with other types of carriers, this anticipated increase in total intercity and local freight volume will expand local trucking business and, thereby, truckdriver employment. The continued growth of suburban areas will contribute to the employment of more drivers.

Some recent developments may offset somewhat the growth in the number of local truckdrivers that would otherwise occur with an increase in freight volume. For example, the trend toward larger deliveries to relatively fewer retail outlets is the result of the growth of chainstores and shopping centers. (On the other hand, as suburban areas expand, local truckers tend to service a wider area, increasing the travel time per truck.) The introduction of new equipment, such as power tailgates for loading and unloading may also affect the number of drivers who will be needed to deliver large and heavy loads. Also, the use of radio telephones to instruct drivers en route will reduce the time needed for deliveries. Innovation in local trucking will continue to be limited, however, by narrow city streets, heavy traffic, and local city ordinances controlling the size and weight of local delivery trucks. However, urban renewal and urban highway building projects may improve driving conditions.

### Earnings and Working Conditions

On the average, hourly union wage scales were \$3.39 for local truckdrivers and \$3 for helpers on July 1, 1966, according to a survey in 68

large cities. Average hourly pay scales for drivers ranged from \$2.72 in New Orleans to \$3.89 in the San Diego area. However, wage scales vary, even in the same city, depending on the type of trucking service (such as general freight hauling or local moving and storage), the types 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 and thus often drive 6 days a week. Although daytime work is customary, nightwork or early morning work is sometimes necessary, particularly for drivers handling foodstuffs for chain grocery stores, produce markets, or bakeries. Most drivers deliver over regular routes or runs, although some may be assigned different routes when they report to work each day.

Local truckdrivers generally have paid vacations of 1 or 2 weeks after a year of service and up to 4 weeks after 16 years. In addition, they usually receive pay for 6 or more national, State, and local holidays.

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.

Practically all unionized local truckdrivers and their helpers are covered by life and health insurance and pension plans which are almost always 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, are subject to nervous strain. The actual operation of a truck has become less physically

demanding because of improvements such as power steering, and more comfortable seating. However, when local drivers make many deliveries during a day, their work can be exhausting. Some drivers may develop physical disorders, such as back strain and hernia. Local truckdrivers do, however, have certain work advantages, such as steady employment. Unlike over-the-road drivers, they usually work a regular daytime schedule and return home in the evenings.

### ROUTEMEN

(D.O.T. 292.358)

#### Nature of Work

Routemen are as much salesmen as they are drivers. In fact, they are sometimes known as *driver-salesmen* or *route-salesmen*. 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 providing services, such as collecting and delivering laundry and dry cleaning, to retail establishments (wholesale routemen) or directly to the public (retail routemen). Wholesale routemen usually drive heavier trucks. These trucks are refrigerated when dairy products or frozen foods are carried.

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. The retail routemen serving homes make from 5 to 10 times as many stops as the wholesale routemen who serve stores and other business establishments.

Routemen's work 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 drycleaning 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 at 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 he can collect the amount of money due.

Although all routemen must be able to get along well with people, it is particularly important for the drycleaning and laundry routeman. His reaction to complaints and requests for special services may be the difference between increasing business or losing customers. Periodically, he calls at homes and business establishments along his route which are not using his company's services to try to get their trade.

A wholesale routeman, for example, may deliver 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 orders of 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 he has delivered. He also 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. From time to time, he calls on grocers along his route, who are not his customers, and tries to get orders from them.

Although the vending machine routeman merchandises his products through machines, he, like other routemen, must try to anticipate customers' needs for service and preferences for merchandise. In his continuing effort to find profitable locations for the vending machines he services, the routeman discusses with managers of commercial and other business establishments the placement and relocation of machines. He caters to customer demand by noting their preferences for merchandise sold at each machine location, and stocks the machines with items that sell best.

The vending machine routeman must also make certain that his machines are adequately supplied with merchandise, that they function properly, and are clean and attractive. At each location the routeman checks the items remaining in the machine and the money deposited in the cash box to determine that what has been sold is accounted for. He tests stock delivery and change-making mechanisms to make sure that items and change are dispensed properly when coins are inserted, and he may make minor adjustments to machines that are not working properly. He cleans the machine, removing waste, spillage, and accumulated dust, and then replaces depleted stock. The routeman keeps an exact record of the merchandise that goes into each machine,

and a precise account of how much money is taken out.

### Where Employed

About 255,000 routemen worked for a wide variety of businesses in 1966. Since most of them 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 large cities in dairies, bakeries, food and beverage distributors, and drycleaning plants.

Some were engaged in wholesale distribution of goods and services to stores and other business establishments, although the majority distributed goods and services to homeowners and apartment dwellers. Many companies employed both wholesale and retail routemen.

### Training, Other Qualifications, and Advancement

In addition to being a good driver, a routeman must have sales ability. To induce people to buy, he must have a thorough knowledge of the product or service he is selling and a persuasive personality. Other important sales qualifications are a pleasant voice, ability to speak well, and a neat appearance. He also needs to have self-confidence, initiative, and tact.

He must be able to 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 driving permit. Information regarding this license can be obtained from State Motor Vehicle Departments.

Applicants for jobs as vending machine routemen should have some mechanical ability. Routemen are expected to check the operation of auto-

matic dispensing devices, and make necessary adjustments and minor repairs. In case of major malfunctions in equipment, they should be able to report the nature of the trouble.

Most employers require their routemen to be high school graduates, preferably 25 years of age or older. Many large companies give applicants aptitude and other psychological tests to determine whether they will make good salesmen and safe drivers. Those who handle a great deal of money may be required by employers to be bonded.

High school courses in salesmanship, public speaking, driver-training, bookkeeping and business arithmetic, and school-work programs in retail and wholesale merchandising are helpful to a person interested in entering this occupation. Immediately following high school, valuable experience may be obtained 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. 292.887). For this job, employers usually hire boys 18 years of age or over who have a driver's license. Helpers are not likely to be used in the dairy or vending machine industries, however. Still another way of becoming a routeman is to get a job (plant or office) in a bakery, dairy, laundry, or drycleaning establishment. After learning something about the business, a young man may get a job as a routeman when an opening occurs.

Most companies give their routemen on-the-job training which varies in length and thoroughness. Many 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.

Routemen may be promoted to route foreman or sales supervisor, but these jobs are relatively scarce. Ad-

vancement is usually limited to moving from a retail to a wholesale route where earnings are generally higher. However, some routemen obtain better paying sales jobs as a result of the experience gained in route selling.

### Employment Outlook

The total number of routemen is expected to increase slightly in the 1970's, although job opportunities will vary among different types of employers. There will be a few thousand additional openings for new workers each year as experienced workers transfer to other fields of work, retire, or die.

The number of retail routemen declined in the decade following World War II, particularly among drivers handling milk and dairy products. However, the decline appears to have run its course, and some employment upturn is likely. The convenience of home delivery to suburban families consuming large quantities of milk and dairy products makes such service popular, despite the growth of local shopping centers. For laundry and drycleaning retail routemen, the outlook is for an increase in employment, in line with population growth, especially in areas with a large concentration of apartment houses. The increasing number of married women working outside the home will also result in more laundry or cleaning work being done commercially.

Employment of wholesale routemen probably will remain at about present levels or rise slightly. Although large supermarkets have been replacing small neighborhood stores, more supermarkets are being built in the suburban areas. The number of routemen will not increase correspondingly, however. There has been a growing trend toward larger delivery trucks. Moreover, in recent years, some manufacturers and wholesale food companies have replaced their routemen with salesmen who cover assigned territories by

automobile, and truckdrivers who make the deliveries.

In the long run, population expansion, higher family incomes, and the growing tendency for housewives to take outside employment will create a continuing need for the door-to-door services of retail routemen. The demand for wholesale routemen will increase because of larger sales of traditional products and the introduction of new items. New lines of frozen foods, for example, are often introduced and marketed by wholesale routemen.

Opportunities for employment as vending machine routemen will be excellent through the mid 1970's, because of the expected rapid increase in the volume of machine-vended merchandise. Some of the factors expected to stimulate the industry's growth are: The development of new and improved machines; and the greater use of automatic food service in industrial plants, schools, hospitals, and department stores, as well as in transportation terminals, shopping centers, and other high-traffic areas.

### Earnings and Working Conditions

Most routemen are paid a salary plus a percentage of the sales or collections they make. Earnings vary considerably according to the product sold and also among routemen selling the same product. 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 of products.

According to a BLS study of union wages and hours in 1966, routemen in the bakery industry had minimum weekly salaries ranging from \$101 to \$150. The minimum weekly salaries for routemen in the dairy industry ranged from \$105 to \$151.

The number of hours worked by routemen varies. Some work only

about 30 hours a week; others may work as many as 60 hours or more a week, depending upon whether the individual 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. For some, the hours of work generally are limited by union-management contract. In other cases, the contract specifies merely the earliest hour that work may begin and the latest quitting time. The hours 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; in the winter, they may work less than 30 hours a week.

Many companies require routemen to wear uniforms. Some employers pay for the uniforms and for keeping them clean.

Most routemen receive paid vacations, generally ranking from 1 to 4 weeks, depending upon length of service, and 6 or more paid holidays a year. Many employers provide hospitalization and medical benefits; some have pension plans.

The routeman is on his own to a great extent. 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 and the daily meeting and dealing with people on the route appeal to many young men. On the other hand, a retail routeman has to make deliveries in bad weather, and do a great deal of lifting, carrying, and walking up and down stairs. He may also have to work unusual hours. For example, retail routemen delivering milk generally work in the very early morning 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 belong to the unions which represent the plant workers of their employers.

## INTERCITY BUSDRIVERS

(D.O.T. 913.363 and .463)

### Nature of Work

The drivers of the buses which travel between cities are selected on the basis of their driving skill, emotional stability, and courtesy. A driver's duties generally begin when he reports to the terminal for his assignment. Before beginning his scheduled trip, he inspects the bus carefully at the terminal or garage. He checks the fuel, 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 express and mail to be carried.

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 usually—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 and

package express into the baggage compartment. He checks the loading plan so that the baggage can be unloaded at the proper destination with minimum effort. He also collects cash fares from passengers who board the bus between stations where tickets are sold.

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 and package express wherever necessary. He announces regular stops and rest or lunch stops. The driver also regulates lighting, heating, and air-conditioning equipment for the passengers' comfort. In an emergency, he is sometimes required to make minor road repairs such as changing tires, for which he generally receives extra pay.

Upon arriving at his final destination, the driver unloads or supervises the unloading of the remaining baggage and turns in the lists of 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 U.S. Department of Transportation (USDOT). The driver must make a complete report if an accident or unusual delay occurs.

### Where Employed

Approximately 27,000 intercity busdrivers were employed by about 1,400 bus companies in 1966. About 18,000 of these drivers worked for the 166 large class I intercity companies—those with annual revenues of over \$200,000. Intercity busdrivers are employed in the many small communities served by bus as well as in the larger cities in which home and regional offices and major terminals of bus companies are located.



### **Training, Other Qualifications, and Advancement**

All intercity busdrivers are required to meet minimum age, health, and experience qualifications established by the USDT. The minimum age requirement is 21 years. The applicant must be able-bodied and have good hearing and at least 20/40 eyesight with or without glasses. He must have at least 1 year's driving experience (through all four seasons) with a good driving record, and must be able to read and speak English.

Many intercity bus companies, however, have considerably 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 large companies do not accept applicants who wear glasses.

Young persons interested in becoming busdrivers 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 busdrivers work under considerable tension when they operate large vehicles in heavy and swiftly moving traffic. Since they represent their companies in dealing with passengers, busdrivers 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 busdriver's job must have or obtain a chauffeur's license, which is a commercial driving permit.

Most intercity bus companies conduct training programs for beginning drivers. These programs, which usually last from 2 to 6 weeks, but can extend to 3 months, include both classroom and driving instruction.

In the classroom, the trainee is instructed in company and USDT 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, working under strict supervision, he makes regularly scheduled trips with passengers.

New workers start out on the "extra board," which is a list of drivers on call 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, drive a second or overload section, make an extra trip if necessary, or drive chartered buses. Extra drivers may have to wait several years before they have the necessary seniority to receive a regular assignment. However, if it becomes necessary for a company to lay off some of its drivers, the extra drivers will be the first to lose their jobs and the last to be rehired. In almost all companies, it is necessary for a beginning employee to serve a probationary period lasting, as a rule, from 30 to 90 days.

Opportunities for promotion are generally somewhat limited, particularly in small companies. An experienced driver may be promoted to a job as dispatcher, supervisor, or terminal manager. For most drivers, advancement consists of receiving better assignments with higher earnings, as their seniority increases.

### **Employment Outlook**

The upward trend in the employment of intercity busdrivers in recent

years is expected to continue. The number of these drivers is expected to increase moderately through the 1970's, as a result of further increase in intercity bus travel. Several hundred additional openings will also be available each year in this relatively small occupation as a result of transfers to other fields of work, retirements, and deaths.

Population growth and higher consumer incomes during the years ahead should result in an increase in travel generally, a portion of which is expected to be by bus. Some other factors which are expected to increase travel by bus are: More new and improved highways, which will probably continue to cut scheduled running time; increasing numbers of larger and more comfortable buses; and more deluxe express buses offering hostess services, refreshments, and other conveniences. Bus traffic will also be favorably affected by touring and charter services and by bus delivery of package express and first-class mail which have become important sources of revenue in the past several years. The further curtailment or elimination of railroad passenger service in many areas is also increasing intercity bus traffic.

### **Earnings and Working Conditions**

Drivers (including extra men) employed by class I intercity bus companies had average earnings of \$7,974 in 1966. Many regular drivers employed by these companies earned considerably more than \$10,000 a year.

The wages of intercity busdrivers are typically computed on a mileage basis. Rates ranged from about 8½ to more than 13 cents a mile in 1966. Most regular drivers are guaranteed specified wages in terms of miles or hours per pay period. For all work other than their regular assignment or "tour of duty," they receive additional pay, customarily at premium rates.

Extra drivers are usually paid by the hour when they are on call but

are not driving, and 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. Extra drivers receive a weekly or biweekly guarantee either in minimum hours, mileage, or earnings.

Most drivers who work for the large companies average between 32 and 36 hours driving time a week. Driving schedules may range from 6 to 10 hours a day and from 3½ to 6 days a week.

USDT regulations limit the hours of work of intercity busdrivers. According to these 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 60 hours of "on-duty" time in a 7-day period; those who work for carriers that operate on every day of the week, however, are limited to 70 hours in an 8-day period. "On-duty" is the period from the time the driver is required to report for work until he is relieved. For those who drive less than 10 hours but perform other work for the bus company, the regulations prohibit resumption of driving after any combination of driving and other on-duty time which totals 15 hours, unless the driver has first had at least 8 hours off duty.

Most intercity busdrivers belong to the Amalgamated Transit Union. The Brotherhood of Railroad Trainmen, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) have also organized intercity busdrivers in some areas.

Labor-management contracts covering many intercity busdrivers provide for health and life insurance paid for by the employer, while pension plans under such agreements are

usually financed jointly by the workers and their employers.

Drivers are given vacations with pay ranging from 1 to 4 weeks, depending on the company for which they work and their length of service. Many also receive 6 paid holidays. When away from home terminals overnight, drivers employed by some companies receive pay for food and lodging.

Driving an intercity bus is not usually physically burdensome, but it is demanding and requires steady nerves. The busdriver is given a great deal of independence in his job, and is solely responsible for the safety of the passengers and bus. Many drivers enjoy working without direct supervision and take pride in assuming these responsibilities. Some drivers enjoy the opportunity to travel and to meet the public.

Among the less desirable aspects of this job are weekend and holiday work and the necessity of being away from home for varying periods. Also, 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 sometimes be laid off when business declines.

### Where To Go for More Information

For information regarding job opportunities for an intercity busdriver, a young man should apply to intercity bus companies or the local office of the State employment service.

## LOCAL TRANSIT BUSDRIVERS

(D.O.T. 913.363 and .463)

### Nature of Work

Local busdrivers transport millions of Americans to and from work, schools, and homes, 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 busdriver's workday begins when he reports to the terminal or garage. There, he is assigned his bus, and 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 very small local bus companies may also require him to check the water, oil, and fuel.

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, and also issues transfers, sells tokens, and makes change. The local busdriver often answers questions concerning schedules, routes, transfer points, and street numbers, and is sometimes required to call out the name of the street at each regular bus stop. He also regulates heating, air conditioning, and lighting equipment to keep the passengers comfortable.

At the end of his day's run, the busdriver turns in a trip sheet which usually includes a record of fares received, trips made, and any delays in schedule. In case of accident or an unusual delay, the driver must make out a comprehensive report on its nature and cause.

### Where Employed

In 1966, about 70,000 busdrivers were employed by about 1,200 local transit bus companies. A small proportion of these drivers were women. Approximately one-half the total worked in large cities where the transit system was publicly owned, such as Boston, Chicago, Cleveland, Detroit, Los Angeles, Miami, New York, Pittsburgh, St. Louis, and San Francisco. In addition to those employed by the local transit bus industry, some local drivers work for





Most local transit companies conduct training courses which may last several weeks and include both classroom and driving instructions. In the classroom, 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's driving instruction consists of supervised trips both with and without 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 passing 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 also may drive charter and sightseeing runs, and other extra runs such as special service buses for public meetings and sporting events. In almost all companies it is necessary for a beginning employee to serve a probationary period—generally lasting for 30 to 90 days. He remains on the extra list until he has the necessary seniority to obtain a regular run. It may take from several months to several years before he is assigned a regular run.

Promotional opportunities in regular driving jobs are generally limited. Experienced drivers may advance to jobs as instructor, dispatcher, road supervisor, and, sometimes, executive. Promotion in municipally owned bus systems is usually by examination. The opportunities for advancement of most drivers are limited to assignments to more desirable runs. Only after acquiring sufficient seniority do the drivers receive these assignments.

**Employment Outlook**

There will be a small number of opportunities for new workers to enter this occupation each year through the 1970's, even though employment of local busdrivers is ex-

charter and sightseeing lines, government agencies, and for companies which specialize in operating schoolbuses. (There are also 15,000 to 25,000 full-time schoolbus drivers and perhaps as many as 150,000 more part-time drivers.) A few drivers are employed by Federal, State, and local governments.

Although many drivers work in major metropolitan areas such as New York, Chicago, and Detroit, some are employed in almost every community in the Nation.

**Training, Other Qualifications, and Advancement**

Applicants for busdriver positions should be between the ages of 21 and 40, of average height and weight, and have good eyesight—with or without glasses. The applicant must be in good health, with no physical disabilities, and must be able to pass the written and physical examinations given by most employers. He

must be able to judge distance 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 high, 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. A good driving record is essential because a busdriver is responsible for the safety of his passengers. Most States require busdrivers 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 experience operating a truck or bus.

pected to continue to decline (but at a slower rate than in the past). These openings will result from the need to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths may account for more than 1,700 openings each year.

In recent years, there has been a considerable decline in the volume of passenger traffic handled by the local transit bus industry. The main cause of this decline has been the rapid rise in the number of private automobiles and their increasing use in both city and suburban areas. Another factor has been the rapid growth of suburbs, most of which have a wide variety of stores, theaters, restaurants, and other services in their shopping centers. Because most suburban shopping centers have good parking facilities and are easily reached by automobile, many suburban residents have found it unnecessary to use public transportation for shopping or other activities. The increasing number of people employed in suburban areas are likely to rely more on private automobile transportation than those employed in downtown areas. In addition, increasing traffic congestion and parking problems in most downtown sections have led to the decline of many central business districts. This, in turn, has resulted in some 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 busdrivers also declined. The decline in employment was limited, however, partly because transit companies are not completely free to curtail or eliminate unprofitable routes, since the companies are usually regulated by State or municipal authorities.

Downtown traffic congestion and parking problems will continue to encourage bus travel in downtown areas, and the growing need for bus service for school children in the suburbs is an additional factor which may slow the downward trend in busdriver employment. Some increase in

the number of publicly owned companies may occur. This would favorably affect busdriver employment, since such companies often provide service on unprofitable routes in the public interest.

### Earnings and Working Conditions

Local transit busdrivers 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. Nearly all companies pay the maximum job rate after 12 months' service. According to a survey of basic hourly wage scales set by union-employer contracts for busdrivers in 67 large cities, the average hourly rate was \$2.98 on July 1, 1966. For two-thirds of the busdrivers covered by the contracts, scales ranged from \$2.90 to \$3.40 an hour. Hourly scales were highest in the larger cities in the Great Lakes, Pacific, New England, and Middle Atlantic regions. Among the cities surveyed, the hourly pay scales for experienced busdrivers ranged from \$1.74 in Knoxville, Tenn., to \$3.34 on one busline in Pittsburgh. Wage scales for beginning drivers were generally 5 to 15 cents an hour less.

Most busdrivers have a standard work schedule of 8 hours a day, 40 hours a week. For additional work, drivers usually receive 1½ times their hourly rates. In many companies, drivers often work in excess of their standard work schedule, thereby increasing their weekly earnings. Drivers on the extra list 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. Most transit companies run some buses in the evening and a few companies operate 24 hours a day. Therefore, some drivers have to work at night. To accommodate the varying demands of commuter travel, it is

necessary for many local transit busdrivers to work "swing shifts." On these runs the operator drives for several hours, is off duty for a period of time, then returns to work for several hours. If the total elapsed time between the beginning and end of a swing shift exceeds 10 or 11 hours, the driver generally receives extra pay. Other assignments are "straight runs" which are unbroken except for meal periods. Some union contracts require 50 to 60 percent of all assignments to be straight runs.

Nearly all local transit busdrivers are covered by labor-management contracts which provide for life and health insurance, and pension plans; the major pension plans are financed jointly by the workers and their employers, while many life and health insurance plans are paid for solely by the employer. Drivers also are given vacations with pay ranging from 1 to 5 weeks or more, depending on the length of service, and usually 6 or 7 or more paid holidays a year.

Although driving a bus is not physically exhausting, busdrivers 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 steady year-round employment once a driver receives a regular assignment. Busdrivers are usually free of direct supervision—which many drivers also find desirable. Drivers take pride in being solely responsible for the safety of the passengers and bus and in acting as the bus company's representative to the general public.

Most busdrivers are members of the Amalgamated Transit Union. Drivers in New York City and several other large cities belong to the Transport Workers Union of America. The Brotherhood of Railroad Trainmen and International Brotherhood of

Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) have also organized some local transit busdrivers.

### Where To Go for More Information

For information on employment opportunities for local busdrivers, inquiry should be made at the transit company in the local area or to the local office of the State employment service.

## TAXI DRIVERS

(D.O.T. 913.363)

### Nature of Work

In practically all communities, taxicabs are an essential part of the regular transportation system. Taxicab drivers, in addition to providing transportation, also perform other services. For example, they assist passengers in and out of the cab, handle their luggage, and may also pick up and deliver packages. In some communities, cabs are used for transporting crippled children to and from school. Cabdrivers occasionally provide sightseeing tours for out-of-town visitors.

Drivers get their "fares" or passengers in one or more ways. The majority of taxicab fleets are equipped with two-way radio systems over which requests for taxicabs are transmitted to the driver. These companies also have cabstands at which drivers may wait for phone calls from their central dispatching office which will direct them to pick up passengers. Many drivers wait in front of theaters, hotels, bus terminals, railroad stations, and other buildings which may have large numbers of prospective passengers. 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. A good driver keeps himself informed on what is happening in the city, where crowds will gather (for example, at theaters, and baseball and football games) and the times when the crowds will break.

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 cabdriver owns his own cab or if he rents a cab over an extended period of time, he may periodically clean the cab, as required by regulations in many municipalities. In large cab companies, this job is generally performed by cleaners employed by the company.

### Where Employed

In 1966, approximately 85,000 taxi drivers, including a small number of women, were employed full time in the taxicab industry, which is made up of both privately owned cabs and fleets of company-owned vehicles. In addition, perhaps as many were employed part time.

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 cabdrivers.

### Training, Other Qualifications, and Advancement

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, safety department, or Public Utilities Commission. Although licensing requirements vary considerably among cities, in general, applicants must be over 21 and in good health, have a good driving record, and have no criminal record. A driver's record is checked for arrests, both locally and through the Federal Bureau of Investigation (FBI).

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 50 cents 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 dis-



patcher 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. In some large cities, however, the number of cabs is restricted by ordinance, which may limit the opportunity to own cabs in such areas.

### Employment Outlook

There will be many opportunities for new workers to become taxi drivers during the rest of the decade and throughout the 1970's, primarily because of the high turnover in this occupation. The number of taxi drivers has been declining during the past decade and this trend is expected to continue through the 1970'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 where most people drive their own cars. However, increasing population, higher consumer incomes, parking difficulties, and higher local transit bus and streetcar fares are some of the factors which may lead to a greater use of taxicabs and limit the decline in employment of taxi drivers.

The high turnover in this occupation results from the lack of assurance of a steady income, long hours, and the use of this job by some workers as stopgap employment when better

jobs are not available. Transfers from this occupation are expected to be the major reason that employment opportunities will be available for many new workers who wish to enter this field of driving.

### Earnings and Working Conditions

Comprehensive data on earnings of taxi drivers are not available. Some taxi drivers covered by union-employer contracts have weekly guaranteed minimums up to \$60 or \$70 a week; a daily rate of \$15 is paid in one western city.

In one major eastern city with a large number of taxicabs, a full-time taxi driver earned, with tips, about \$125 a week for a 6-day week, in early 1966. 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. Many drivers rent their cabs from the company by the day for a set price. 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

between 3 p.m. and 5 p.m. Some drivers work on Sundays and holidays.

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 in all kinds of weather, and dealing with all types of passengers.

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 practices.

Taxi drivers in many of the large cities belong to labor unions, particularly those drivers 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.).

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.

## FORGE SHOP OCCUPATIONS

Forging is one of the principal methods of working and shaping metal. In the forging process, metal is first heated to the proper temperature in special furnaces and then shaped through pounding and squeezing by hammers and presses. Shaping metal by forging has been done for centuries by blacksmiths, but the modern forge shop, by substituting heavy power equipment and precision die blocks for the blacksmith's hand hammer and anvil, can do it much more rapidly and accurately.

Forged metal is exceptionally strong and is used for many products that must withstand great stress. Examples of forged products include automobile crankshafts, gears, wrenches, scissors, and many parts of aircraft, missiles, and spacecraft. The great bulk of forging tonnage is made of steel, but aluminum, brass, bronze, copper, titanium, beryllium, and most other metals also are forged. Forgings range in weight from fractions of a pound to many tons.

This chapter describes the major kinds of forging production occupations; it does not discuss machining, maintenance, custodial, or other workers who are employed in forge shops but who are not directly engaged in the forging process. (For a detailed description of the duties, working conditions, and job prospects for blacksmiths, who do work similar

to that of many forge shop workers, see the statement on Blacksmiths.)

### Nature of Work

Before metal can be shaped by hammers and presses, workers known as heaters must first heat it in intensely hot furnaces. Then drop hammer operators, hammersmiths, press operators, upsetter operators, and other workers manipulate the glowing hot metal between a pair of metal forms, called dies, that are attached to power hammers or presses. The hammers or presses pound or squeeze the metal with tremendous but controlled force to form it into the shape desired. Finally, trimmers, chippers, grinders, and other workers remove rough edges, excess metal, and any imperfections from forgings, and perform other finishing operations.

Two kinds of dies are used for forging—the impression (closed) die, which has a cavity shaped to the form of the metal part to be forged, and the open die, which is flat and more closely resembles the blacksmith's hammer. Impression dies are used where the need for large quantities of identical forging (for example, automobile crankshafts) justifies their expense. Open dies are used to produce relatively small numbers of forged parts, or to forge objects too large for impression dies.

The basic equipment used by forge shop workers consists of various types of power hammers, power forming and trimming presses, dies, and furnaces. They also use handtools, such as hammers and tongs, and measuring devices, such as calipers, scales, and rules. A forging hammer or press generally is operated by a crew of from 2 to 10 men. The size of the crew depends on the size and type of equipment operated and the size and shape of the part to be formed. Crews may specialize in the operation of a particular kind of hammer or press. The work performed by workers in the major forge shop occupations is as follows:

*Hammersmiths* (D.O.T. 610.782) are skilled workers who supervise the operation of open-die power hammers that pound pieces of hot metal, called blanks or stock, into desired shapes. The precision of parts forged with such equipment is greatly dependent on the skill of the hammersmith. He must interpret blueprints, drawings, and sketches to determine how to work the metal under the hammer; determine the force of the hammer so that the piece being forged will be shaped to specifications; and decide whether the metal being worked needs additional heating and when and how to use various forming tools under the hammer to produce angles and curves.

The hammersmith supervises a crew consisting of a hammer driver, or hammer runner, whose main duty is to operate controls of the hammer to regulate the force of the forging blow; a craneman, who transfers metal blanks from furnace to hammer and manipulates metal under the hammer; a heater, who heats metal to correct forging temperatures; and one or more helpers.

*Hammer operators* (D.O.T. 610.782), often called hammermen, are skilled forgemen who operate impression-die power hammers. Generally, the larger the hammer and the larger or more intricate the shape of the metal object to be formed, the greater the skill required of the operator. With the assistance of helpers and heaters, the hammerman performs such duties as setting and aligning dies in the hammer, controlling the force of the forging blow, positioning and manipulating metal under the hammer, and determining whether the metal being forged needs additional heat.

*Press operators* (D.O.T. 611.782 and .885) operate huge presses equipped with either open or impression dies. Their work differs from that of the hammersmith or hammer operator mainly in that they shape and form hot metal by pressing or squeezing rather than by hammering

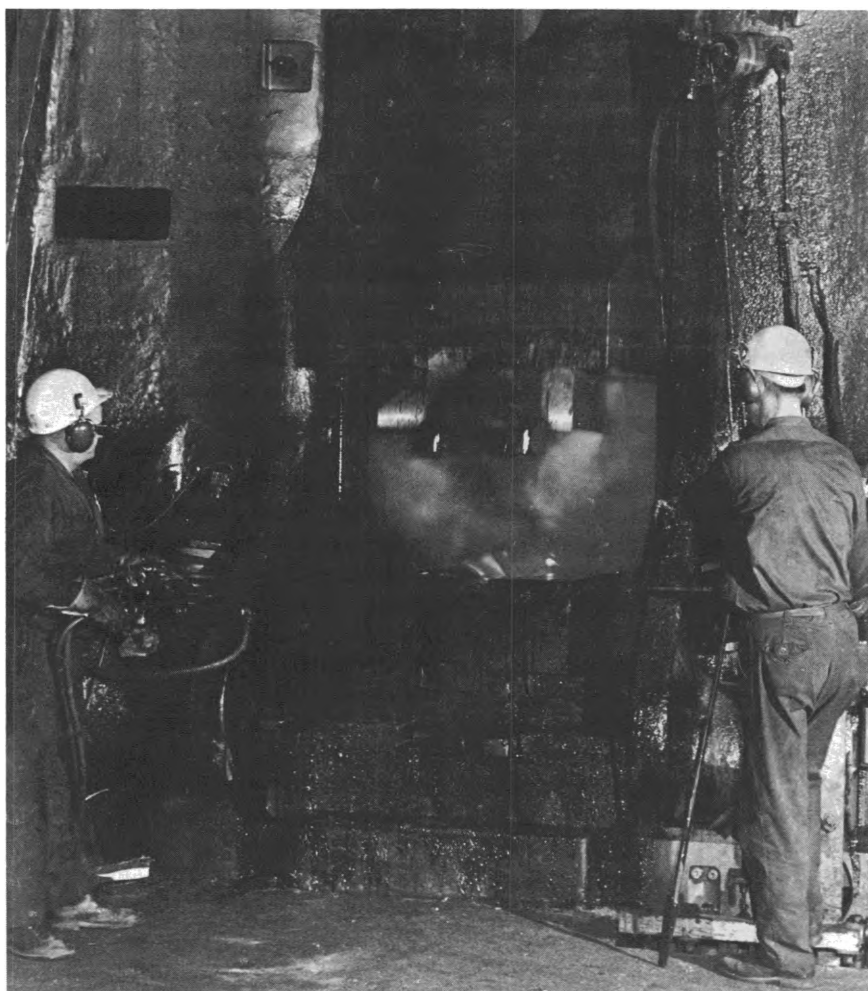
or pounding. They must know how to regulate the pressure of their machines and position metal stock between the dies. In some cases, operators need to know how to control the heating of metal. Their duties also may include setting up dies in the presses.

Skills of operators of open-die forging presses are similar to those of hammersmiths. Both types of workers manipulate metal blanks between two open dies; both must be able to understand blueprints, drawings, or sketches in order to transform heated metal into finished forgings; and both may supervise crews composed of an assistant operator, a crane man, a heater, and several helpers.

Impression-die press operators work to more exacting specifications than press operators using open dies, but do not need as much manipulating skill because the die impression determines the shape of the forging. The impression-die press operator may supervise a small crew or may work alone.

*Upsetter operators* (D.O.T. 611.782), also called upsettermen, operate machines that shape hot metal by applying pressure through the horizontal movement of one impression die against another. With the help of a heater and several helpers, the upsetter operator performs such duties as alining dies, positioning metal stock between the dies, adjusting the machine's pressure on the metal stock, and controlling the heating of the metal. Deep-socket wrenches, aircraft engine cylinders, bolts, and valves are examples of products made in large quantities on upset machines.

*Heaters* (D.O.T. 509.782) control the supply of fuel and air in forge shop furnaces to obtain the correct temperature and proper type of atmosphere for the kind of metal and object being forged. Temperature gages and observation of the metal's color help the heater determine when the correct temperature has been reached. The heater's duties also include transferring, with tongs or me-



Hammer operator and helper forge blades on steam hammer.

chanical handling equipment, heated metal from furnace to hammer or press, and keeping furnaces clean.

*Inspectors* (D.O.T. 612.585) check forgings for size, shape, quality, and other specifications. Some inspectors examine forged pieces for flaws and faulty workmanship while the forgings are still hot; others inspect forgings after they have been trimmed and cleaned. Inspection may be done visually and/or with gages, micrometers, calipers, and other measuring devices. Checking for flaws also may be done with machines that test for strength and hardness, and with magnetic and electronic testing devices.

*Die sinkers* (D.O.T. 601.280) are highly skilled workers who make the impression dies that are used on some

forging hammers and presses. Working from a blueprint, template, or drawing, a die sinker traces the outline of the object to be forged on two matched blocks of steel. He then mills the shape of this object in the steel die blocks to close tolerances, using milling machines and other machine tools such as EDM (electric discharge machinery) and ECM (electro chemical machinery). He smooths and finishes the die cavity, using scrapers, hand grinders, and other handtools. Finally, he makes a sample cast of the finished cavity, using the completed dies and checks all measurements with a micrometer and other precision measuring instruments.

Many forge shop workers are employed to clean and finish forgings.

For example, *trimmers* (D.O.T. 619.887) remove excess metal from forged pieces with presses or hammers equipped with trimming dies. *Chippers* use chipping hammers and other tools to remove imperfections from the surfaces of forgings. *Grinders* (D.O.T. 705.884) remove rough edges from completed forgings with mechanically powered abrasive wheels. *Sandblasters* and *shotblasters* (D.O.T. 705.782) operate sandblasting or shotblasting equipment to clean and smooth forgings. *Picklers* (D.O.T. 503.884) dip forgings in an acid solution to remove surface scale and reveal any surface defects. *Heat treaters* (D.O.T. 504.782) heat and cool forgings under controlled conditions to attain certain desired conditions or properties in the metal, such as hardness.

### Where Employed

Approximately 60,000 production workers were employed in forge shops in early 1967. More than three-fourths of these workers were employed in independent shops—those that produce forgings for sale. The remainder worked in forging departments of plants that use forgings in their final products, such as automobiles, farm machinery, handtools, and structural and ornamental metal products.

Employment of forge shop workers is concentrated mainly in Wisconsin, Ohio, Illinois, Michigan, Pennsylvania, Indiana, and Massachusetts. Forge shops usually are located near steel producing centers, which provide steel for forgings, as well as near metalworking plants, which are the major users of forged products.

### Training and Other Qualifications

Most forge shop workers learn their skills through on-the-job training and work experience. They generally join a hammer or press crew as a helper, or, in some plants, as a heater. As they acquire experience, they progress

to more skilled jobs. Advancement to the skilled job of hammersmith, for example, requires several years of on-the-job training and experience.

A few forge shops offer apprentice training programs for crafts such as die sinker, heat treater, hammer operator, hammersmith, and press operator. The programs, which generally last 4 years (in the case of die sinkers, from 4 to 8 years), give the apprentice a combination of classroom training and practical experience in using the tools and equipment of the trade. For example, hammersmith apprentices learn about the properties of metals and how to operate power hammers and furnaces, use handtools and welding equipment, and read blueprints.

Training requirements for inspectors vary. Those who inspect rough forgings visually or with simple gages usually can perform their jobs after on-the-job training lasting only a few weeks. Those who examine parts forged to more exact specifications and operate more complicated testing equipment may be required to have some technical background in blueprint reading and mathematics and may be given several months of on-the-job training.

Employers usually require no more than a grammar school education for helpers and heaters, but high school graduates are preferred. Young men interested in preparing themselves for the more skilled forge shop jobs and for supervisory positions should complete high school and include mathematics (especially geometry), drafting, and shopwork in their studies.

Because forge shop work sometimes involves lifting and moving heavy forgings and dies, workers must be strong. However, cranes are used for moving very large objects. Forge shop workers must have the stamina to work under hot and noisy conditions for an entire working day.

### Employment Outlook

Employment in forge shops is expected to increase moderately through

the 1970's, assuming the realization of relatively full employment and high levels of economic activity. Most job openings, however, will arise from the need to replace experienced workers who retire, transfer to other fields of work, or die. Retirements and deaths alone are expected to result in about 1,600 job openings annually.

A rise in production worker employment is expected in the years ahead because industries that use forgings in their final products—particularly the industrial machinery and automobile industries—are expected to expand with the anticipated rise in the Nation's general economic activity. However, employment of forge-shop production workers is expected to rise at a slower rate than production. Continued improvements in forging techniques and equipment and more efficient plant operations, including materials handling, will result in greater output per worker. Forge shop employment has been sensitive to changes in general business conditions, and it is expected that substantial year-to-year changes in the level of forge shop employment will continue.

New and improved production processes and equipment have been introduced into forge shops in recent years, including the "high energy rate forging machine," the "automated hydraulic press," "no-draft forging," "radial forging," and "electrical discharge machining." Although these innovations are not expected to have any appreciable adverse effect on production worker employment in the near future, their widespread use in the years ahead may reduce the number of workers needed in conventional forge shop production occupations. The high energy rate forging machine, operated by one man, forges metal to very close tolerances—often with a single blow. Products forged by this process have improved physical properties and require less finishing, such as grinding and machining. The automated hydraulic press is controlled automatically by dialed-in instructions or by the use of punched cards, thus requiring smaller forging

crews than are necessary to operate conventional equipment. No-draft forging involves the use of specially constructed dies that permit press forging to closer conformity with required sizes and shape than is possible with conventional dies, thereby reducing machining requirements. Radial forging is a process used for the hot and cold forging of solid and hollow shafts, rifle barrels, and other internally and externally contoured products. This process produces complex shapes without the need for several machining operations. Other production techniques being introduced into forge shops include electrical discharge machining and electro chemical machinery which produces the same results as broaching and grinding on electrically conductive materials without heating or distorting the work piece. This process improves the efficiency of die sinking and machining operations and provides a superior finish to the product.

### Earnings and Working Conditions

Average earnings of forge shop production workers are above those for all manufacturing production workers. In early 1967, production workers in iron and steel forging plants earned an average of \$154.40

a week, or \$3.65 an hour, compared with average weekly earnings of \$113.02 and average hourly earnings of \$2.77 for production workers in all manufacturing industries. In many forge shops, hammer and press crew members are paid on an incentive basis—that is, on the basis of the number of forgings they produce. Consequently, earnings of highly skilled crew members were higher than the average for all production workers in forge shops.

Collective bargaining contracts negotiated between employers and unions include provisions for various fringe benefits, such as holiday pay, vacation pay, and retirement pensions. Most union-management agreements provide for 7 or 8 paid holidays a year and up to 5 weeks' vacation, depending on length of service. Other important provisions include life insurance benefits financed by the employer, as well as accident and sickness, hospital, and surgical benefits.

Working conditions in forge shops have improved in recent years. Many firms have installed heat deflectors and ventilating fans to reduce heat and smoke and have attempted to reduce machine concussion, noise, and vibration. Although the rate of disabling work injuries in forge shops is higher than the average for all manufacturing industries, employers and

unions attempt to eliminate injuries in forge shops by promoting safety training and the use of protective equipment such as face shield, ear plugs, safety glasses, metal-toe shoes, instep guards, metal helmets, and machine safety guards.

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implementation Workers of America; the International Association of Machinists and Aerospace Workers; and the International Die Sinkers' Conference (Ind.).

### Where To Go for More Information

The Forging Industry Association,  
55 Public Square, Cleveland, Ohio  
44113.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers,  
Eighth at State Ave., Kansas City,  
Kans. 66101.

Open Die Forging Institute,  
440 Sherwood Rd., La Grange Park,  
Ill. 60625.



## MACHINING OCCUPATIONS

Almost every product made by American industry contains metal parts or is manufactured by machines made of metal parts. Many of these metal parts are shaped to precise dimensions by skilled and semiskilled machining workers using a wide variety of machine tools. Machining workers make up the largest occupational group in the metalworking trades. In early 1967, more than 1 million workers were employed as machinists, tool and die makers, instrument makers, machine tool operators, setup men, and layout men.

### Nature of Work

The principal job of most machining workers is to operate machine tools. A machine tool is a stationary, power-driven machine that holds firmly both the piece of metal to be shaped and a cutting instrument, or "tool," and brings them together so that the metal is cut to the desired shape. 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, drilling and boring machines, milling machines, shapers, broachers, and planers. Lathes turn and shape metal against a sharp cutting tool.

Grinding machines smooth metal parts by means of power-driven abrasive wheels. Drilling machines make holes in metal. Boring machines enlarge holes already drilled. Milling machines cut or remove excess metal with tools that have several cutting edges. Shapers, planers, and broachers are machine tools that produce flat surfaces. In addition to these common machining methods, several new metal shaping techniques have been introduced in recent years. For example, metal can now be shaped using chemicals, electricity, magnetism, sound, light, and liquids under controlled conditions.

Accuracy is of prime importance for most metal machining work. Motors, farm machinery, and typewriters are included among the wide variety of products made of separate metal parts which must be made to precise dimensions so that they are interchangeable and can be easily assembled for mass-production purposes. Metal parts sometimes are machined to tolerances of 10 millionths of an inch. Machining workers follow directions generally 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 micrometers and other precision-measuring instruments to check the accuracy of their work against the 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 files, scrapers, emery cloths, and miscellaneous small handtools in filing, scraping, and polishing the parts for exact fit in the final assembly.

All-round machinists are skilled workers who can operate most types of machine tools. Machine tool op-

erators commonly operate only one kind of machine tool. Tool and die makers specialize in making dies for use with presses and diecasting machines, devices to guide drills into metal, and special gages to determine whether the work meets specified tolerances. Instrument makers use machine tools to produce highly accurate instrument parts made of metal or other materials.

In plants that produce large numbers of metal products, machinists may specialize in setup and layout work. Setup men adjust machine tools so that semiskilled machine tool operators can run the machines. Layout men mark machining specifications on metal so that an operator can perform the proper machining operations. (Detailed discussions of the types of work performed by workers in each of these machining occupations are presented later in this chapter.)

Since continuous attention is required when machine tools are in operation, the work may be 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 that comes to a capable and conscientious craftsman in a highly skilled trade.

### Location of Machining Work

An estimated 500,000 machine tool operators; 400,000 machinists, layout men, and instrument makers; 150,000 tool and die makers; and 75,000 setup men were employed in early 1967. About four-fifths of all machining workers were employed in the metal-working industries, mostly in the machinery, except electrical; transportation equipment; fabricated metal products; and electrical machinery and equipment industries. Many thousands were employed in nonmetalworking establishments, such as the repair shops of railroads

and maintenance shops of factories that make textiles, paper, glass, or chemicals. A small number worked in research laboratories and shops that fabricate models of new products.

Machining workers are employed in every State and in almost every city in the country. However, more than half of all machining workers are employed in California, Ohio, New York, Michigan, Illinois, and Pennsylvania. Other States with large numbers of machining workers are New Jersey, Massachusetts, Indiana, Connecticut, Wisconsin, and Texas. Most instrument makers are employed in New York City, Chicago, and a few other large cities.

### **Training, Other Qualifications, and Advancement**

The common method of entering skilled machining occupations is through apprenticeship—a period of formal on-the-job training during which the new worker learns all the aspects of his trade. He is taught to operate machine tools, and to use handtools and measuring instruments. In addition to shop training, the apprentice is given classroom instruction in blueprint reading, mathematics, and 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 help determine whether applicants for machining jobs have the necessary mechanical ability and the temperament to perform this exacting work. Machining workers must also have good vision, and superior judgment of depth and distance.

Most machine tool operators and some machinists, tool and die makers, and instrument makers “pick up” the skills of their trade informally through experience on several jobs. They generally start in the less skilled machining jobs working under the supervision of experienced craftsmen. They gradually advance to more skilled jobs as they acquire experience and knowledge. Some workers im-

prove their skills and increase their chances for advancement by taking vocational school courses in blueprint reading, electronics, hydraulics, and shop mathematics. An increasing number of machining workers are participating in intensive training programs provided by machinery manufacturers or sponsored by labor unions. Some of these programs train machining workers to maintain and repair the numerically controlled machine tools being installed in a growing number of establishments.

Programs to train unemployed and underemployed workers, primarily for entry jobs in the machining occupations, were operating in many cities in early 1967 under the Manpower Development and Training Act. The majority of these programs, which last up to a year, were for machine tool operators, but some were for other machining occupations. The programs stressed the fundamentals of machine tool operation. With additional training and experience, graduates of these programs may eventually become skilled machining workers.

Although women are sometimes employed as machine tool operators, relatively few are employed in skilled machining occupations.

Machining workers have several advancement opportunities. For example, many can advance to foremen. Individuals with extensive machine shop experience may, with specialized training, become programmers who prepare the coded paper tapes used to operate numerically controlled machines. Tool and die makers and instrument makers can advance to technical positions such as tool and die designer or instrument technician. Machining workers also can open their own tool and die shops or machine shops.

### **Employment Outlook**

There will be thousands of job openings for machining workers during the remainder of the 1960's and throughout the 1970's. Most of these openings will result from the need to

replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will provide about 25,000 job openings annually. Replacement needs will be a particularly important factor in the skilled machining occupations, which have a relatively high proportion of older workers. Transfers of semiskilled machine tool operators to other occupations are fairly common, and some openings will also result from these transfers. Other openings are expected to result from the anticipated slow increase in the demand for these workers, assuming the realization of relatively full employment nationally and high rates of economic growth necessary to achieve this goal. If these high levels of economic activity are not realized, the employment of machining workers will increase less than expected.

Employment in the various machining occupations is expected to increase at different rates. For example, the number of instrument makers is expected to increase rapidly, while little or no change is expected in the employment of machine tool operators. Laborsaving technological changes are expected to slow the employment growth of most machining occupations.

The anticipated increase in the employment of machining workers is expected to result from the rapid rise in the demand for machined products. The large increases expected in population and in the number of households, and the higher levels of personal disposable income anticipated during the decade ahead, are expected to result in a large increase in the demand for metal consumer products such as automobiles, heating and air-conditioning equipment, and household appliances. Higher levels of corporate income and rising expenditures for industrial plant capacity should stimulate the demand for metal products such as machine tools, engines, pumps, and instruments. The production of machined products used in the exploration of outer space often involves new metals

and alloys that must be worked to extremely close tolerances. Special machining skills will be required to perform this type of work.

Employment of machining workers is not expected to increase as fast as the demand for machined products because technological developments will increase output per worker. For example, automated machining lines, in which machine tools are linked together for production operations, are being used increasingly. The cutting and feeding speeds of machine tools are also increasing. New processes that will be used more frequently in the future for metal removal include chemical and electrical milling, electrical discharge and ultrasonic machining, and machining by electron beams and lasers. The use of powdered metals and advances in metal forming, both of which significantly reduce the amount of machining necessary to produce a final product, may also gain more widespread application in the future. In addition, the growing use of numerically controlled machine tools will adversely affect employment of machining workers, especially operators.

The use of numerically 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. These numbers are punched on tapes or cards which are inserted into electronic or mechanical devices that translate numbers into motions or actions such as drilling or cutting. The machine tool operator simply installs the tool, inserts and removes the workpiece, and changes the tapes or cards.

Numerical controls may greatly simplify the jobs of many machining workers and increase their efficiency. On the other hand, the more sophisticated applications of numerically controlled machine tools will require operators of greater skill and knowledge of machining operations.

**Earnings and Working Conditions**

The earnings of skilled machining workers 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 are among the highest paid skilled workers in manufacturing. Earnings information for most of the individual machining occupations is presented later in this chapter.

Most machine shops are relatively clean and well lighted. 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. They frequently wear safety glasses and other protective equipment.

Machining work is not usually 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 move about frequently.

Companies that employ machining workers generally provide paid holidays and paid vacations. Life insur-

ance, hospitalization, medical and surgical insurance, sickness and accident insurance, and pensions also are often provided for these workers.

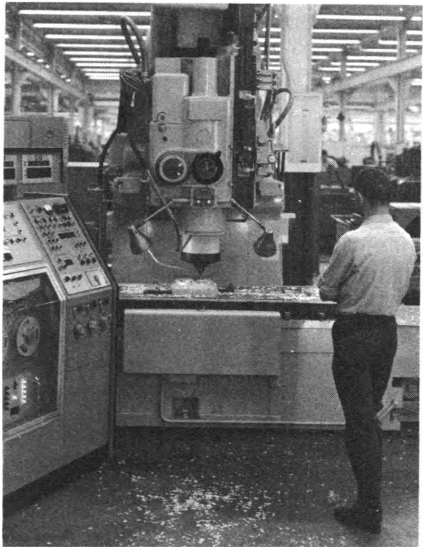
The great majority of workers in machining occupations are members of unions. Among the labor organizations in this field are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

**Where To Go for More Information**

The National Machine Tool Builders Association, 2139 Wisconsin Ave. NW., Washington, D.C. 20007—whose members build a large percentage of all machine tools used in this country—will, on request, supply information on career opportunities in the Machine Tool Industry.

The National Tool, Die and Precision Machining Association, 1411 K St. NW., Washington, D.C. 20005, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U.S. Department of Labor'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 to become an all-round machinist or tool and die maker. In addition, it also may be a source of information about training opportunities under the Manpower Development and Training Act. The State employment service also refers applicants for apprentice programs to employers. In many communities, applications for apprenticeship are also received by la-



Machine tool operator monitors numerically controlled milling machine.

bor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following international unions (which have local offices in many cities):

International Association of Machinists and Aerospace Workers,  
1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,  
8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical Radio and Machine Workers,  
1126 16th St. NW., Washington, D.C. 20036.

International Brotherhood of Electrical Workers,  
1200 15th St. NW., Washington, D.C. 20005.

## ALL-ROUND MACHINISTS

(D.O.T. 600.280 and .281)

### Nature of Work

The all-round machinist is a skilled metal worker who makes metal parts with machine tools. A machinist can set up and operate most types of machine tools. His wide knowledge of shop practice and the working properties of metals, plus his understanding of what the various machine tools do, enable him to turn a block of metal into an intricate part meeting precise specifications.

Variety is the main characteristic of the work of an all-round machinist. He plans and carries through all operations needed in turning out machined products. He may switch frequently from the production of one kind of product to another. An all-round machinist selects the tools and material required for each job and plans the cutting and finishing operations in order to complete the finished



Machinist operates modern machine that combines several processes.

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 or even millionths of an inch. After completing machining operations, he may finish the work by hand, using files and scrapers, and then assemble the finished parts with wrenches and screwdrivers. The all-round machinist may also "heat treat" cutting tools and parts to improve machinability.

Machinists employed in maintenance departments to make or repair metal parts of machines and equipment also have a broad knowledge of mechanical principles. They sometimes adjust and test the parts they have made or repaired for a machine.

### Where Employed

Almost every factory using a substantial amount of machinery employs all-round machinists to keep its mechanical equipment operating.

Some all-round machinists work in the production departments of metal-working factories where large quantities of identical parts are produced; others work in machine shops where a limited number of varied products are made. Most all-round machinists work in the following industries: Machinery, including electrical; transportation equipment; fabricated metal products; and primary metals. Among the other industries employing substantial numbers of these workers are the railroad, chemical, food processing, and textile industries. The Federal Government also employs all-round machinists in Navy yards and other installations.

An important advantage of this occupation is that machinists can be employed in almost every locality and industry because their skills are required to maintain all types of machinery.

### Training, Other Qualifications, and Advancement

According to most training 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. Several companies have training programs which qualify some of their employees as machinists in less than 4 years.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do highly accurate work that requires concentration as well as physical effort. A high school or vocational school education is desirable preparation for machinist training and is required by many employers. Courses in mathematics and physics and some knowledge of electronics and hydraulics may be helpful both during and after apprenticeship training. Some companies require

their experienced machinists to take courses in mathematics and electronics, at company expense, so that they can service and operate the numerically controlled machine tools coming into greater use. In addition, equipment builders generally provide training in the electrical, electronic, hydraulic, and mechanical aspects of machine-and-control systems.

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 learning the operation of 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.

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 may be assigned jobs requiring him to operate several types of machine tools as well as to perform hand operations. Some journeymen machinists, however, remain machine tool specialists who 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, others may become tool and die makers or instrument makers. A skilled machinist has excellent opportunities to advance into other technical jobs in machine programming and tooling. Machinists can also open their own machine shops.

**Employment Outlook**

A moderate increase in the number of all-round machinists is expected during the remainder of the 1960's

and throughout the 1970's, as a result of the anticipated expansion of metalworking activities. (See discussion, p. 386.) However, most job openings will arise from the need to replace experienced machinists who transfer to other fields of work, retire, or die. In this large occupation, retirements and deaths alone will result in about 7,000 job openings annually.

The employment of machinists is expected to increase, especially in maintenance shops, as industries continue to use a greater volume of complex machinery and equipment. Skilled maintenance machinists are needed to prevent costly breakdowns in highly mechanized plants where machine tools often are linked together by transfer equipment. In such plants, a breakdown of one machine may stop many other machines.

**Earnings and Working Conditions**

The earnings of all-round machinists compare favorably with those of other skilled factory workers.

Maintenance machinists employed in various industries in 84 metropolitan areas surveyed in 1965-66 received average straight-time hourly earnings ranging from \$2.31 in Greenville, S.C., to \$3.86 in the San Francisco-Oakland area of California. Average straight-time hourly earnings of maintenance machinists employed in the following cities were:

Atlanta -----	\$3. 24
Birmingham -----	3. 61
Chicago -----	3. 65
Cincinnati -----	3. 40
Detroit -----	3. 72
Houston -----	3. 70
Los Angeles-Long Beach-----	3. 52
Memphis -----	3. 19
Milwaukee -----	3. 70
Minneapolis-St. Paul-----	3. 59
New York-----	3. 71
Portland, Oreg-----	3. 59
Rockford, Ill-----	3. 06
San Francisco-Oakland-----	3. 86
Worcester -----	3. 10

Machinists must follow strict safety regulations when working around

high-speed machine tools. The greater use of safety glasses and other protective devices in recent years has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

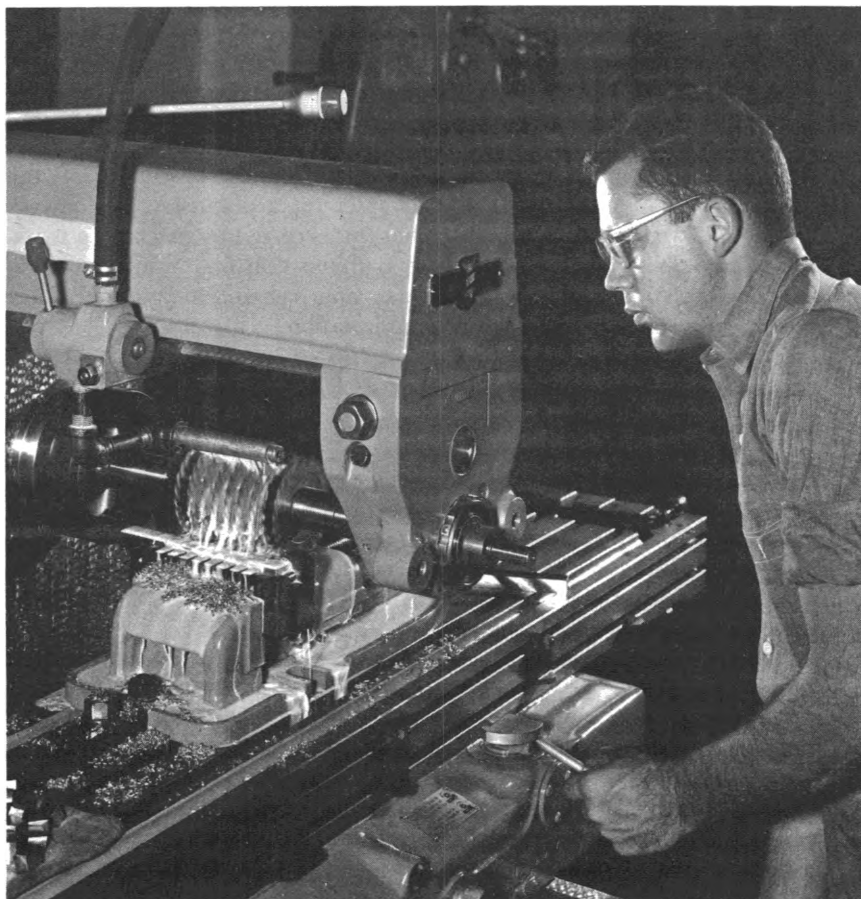
**MACHINE TOOL OPERATORS**

(D.O.T. 600.280; 601.280; 602.280 through .885; 603.280 through .885; 604.280 through .885; 605.280 through .885; and 606.280 through .885)

Machine tool operators shape metal to precise dimensions by the use of machine tools. Most operators can operate only one or two machine tools; some can operate several. Many operators are semiskilled machine tenders who perform simple, repetitive operations that can be learned quickly. Other operators, however, are skilled workers who can perform complex and varied machining operations.

A typical job of a semiskilled operator is to place rough metal stock in a machine tool on which the speeds and operation sequence have already been set by a skilled worker. The operator watches the machine and calls his supervisor when it is not functioning correctly. Special, easy-to-use gages help him to measure work quickly and accurately. The operator who has limited training may make minor adjustments to keep his machine tool operating, but he depends on skilled machining workers for major adjustments.

The work of skilled machine tool operators is usually limited to a single type of machine and involves little or no hand fitting or assembly work. He plans and sets up the correct sequence



Machine tool operator adjusts milling machine in metal cutting operation.

of machining operations according to blueprints, layouts, or other instructions. He adjusts speed, feed, and other controls, and selects the proper cutting instruments or tools for each operation. He must be able to use all the special attachments of his machine because adjustments during machining operations and changes in setup may be required. Upon completing his work, he checks measurements with micrometers, gages, and other precision-measuring instruments to see whether the work meets specifications. The skilled machine tool operator also may select cutting and lubricating oils used to cool metal and tools during machining operations.

Lathes, drill presses, boring machines, grinding machines, milling

machines, and automatic screw machines are among the machine tools used by machine operators. Both skilled and semiskilled operators have job titles 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 mainly employed in factories that manufacture fabricated metal products, transportation equipment, and machinery in large quantities. Skilled machine tool operators work in production departments, maintenance departments, toolrooms, and job shops. Because of their limited training, few semiskilled operators work in maintenance departments or in job shops.

### Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. A beginner usually starts by observing a skilled operator at work. When the learner first operates a machine, he is supervised closely by a more experienced worker. The beginner learns how to use measuring instruments and to make elementary computations needed in shop work. He gradually acquires experience and learns to operate a machine tool, read blueprints, and plan the sequence of machining work.

Individual ability and effort largely determine how long it takes to become a machine tool operator. Semiskilled machine tool operators generally learn their jobs within a few months. However, it usually takes 1½ to 2 years of on-the-job training and experience to become a skilled machine tool operator. Some skilled machine tool operators' jobs are filled by men who have completed machinists' apprenticeships. Some companies have formal training programs to acquaint new employees with the details of machine tool operation and machining practice.

Although there are no special educational requirements for semiskilled operator jobs, young persons seeking such jobs can improve their job opportunities by completing courses in mathematics and blueprint reading. In hiring beginners, employers often look for persons who have mechanical aptitude and some experience working with machinery.

Skilled machine tool operators can advance to jobs as all-round machinists and tool and die makers. They may also advance to jobs in machine programing and maintenance.

### Employment Outlook

Tens of thousands of workers will be hired during the remainder of the 1960's and throughout the 1970's to

replace experienced machine tool operators who transfer to other jobs, retire, or die. Retirements and deaths alone should result in more than 10,000 job openings annually. Little or no employment growth is expected despite the anticipated expansion of metalworking activities. (See discussion, p. 386.)

Technological developments will continue to affect both the number and skill requirements of machine tool operators. The use of faster and more versatile automatic machine tools and the increasingly widespread use of numerically controlled machine tools will result in greater output per worker and tend to limit employment growth. Other factors that may contribute to the slow growth in this occupation are the new processes that are becoming increasingly important in metal removal, such as chemical milling, electrical milling, electrical discharge and ultrasonic machining, and machining by electron beams and lasers. Advances in metal forming and the use of powdered metals may also limit employment growth since they reduce the amount of machining necessary to produce a final product.

Workers who have thorough backgrounds in machining operations, mathematics, blueprint reading, and a good working knowledge of the

properties of metals will be better able to adjust to the changing job requirements that will result from these technological advances.

**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. 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. In 21 selected metropolitan areas surveyed in the middle of 1966, class A machine tool operators had average straight-time hourly earnings ranging from \$2.82 in Dallas, Tex., to \$3.80 in the San Francisco-Oakland area of California. The average earnings of class B operators in the majority of the areas were at least 39 cents an hour lower than the earnings of class A operators. Similarly, the hourly earnings of class C operators were at least 45 cents below the level of class B operators in a majority of the areas. Average straight-time hourly earnings for class A drill press, engine lathe, and milling machine operators were as follows:

Machine tool operators are required to wear protective glasses and to avoid wearing loose-fitting garments when working around high speed machine tools. Increasing emphasis upon these and other safety regulations has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

**TOOL AND DIE MAKERS**

(D.O.T. 601.280, .281, .380, and .381)

**Nature of Work**

Tool and die makers are highly skilled, creative workers whose products—tools, dies, and special guiding and holding devices—are the basis of mass production in metalworking industries. Toolmakers specialize in producing jigs and fixtures (devices required to hold metal while it is being shaved, stamped, or drilled). They also make gages and other measuring devices that are used in manufacturing precision metal parts. Die makers construct metal forms (dies) which are used in stamping and forging operations to shape metal. They also make metal molds used in diecasting and in molding plastics. Tool and die makers also repair worn or damaged dies, gages, jigs, and fixtures. Some tool and die makers help design tools and dies.

In comparison with most other machining workers, tool and die makers have a broader knowledge of machining operations, shop practices, mathematics, and blueprint reading, and can work to closer tolerances and do

	<i>Drill press operators, radial, class A</i>	<i>Engine lathe operators, class A</i>	<i>Milling, machine operators, class A</i>
Baltimore.....	\$3.27	\$3.04	\$3.38
Boston.....	3.14	3.08	3.05
Buffalo.....	2.91	3.04	.....
Chicago.....	3.29	3.41	3.39
Cleveland.....	3.26	3.25	3.38
Dallas.....	2.62	2.85	2.82
Denver.....	3.47	3.22	3.46
Detroit.....	3.64	3.72	3.64
Hartford-New Britain-Bristol.....	3.04	3.17	3.20
Houston.....	2.97	3.24	3.09
Los Angeles-Long Beach.....	3.11	3.37	3.26
Milwaukee.....	3.27	3.49	3.53
Minneapolis-St. Paul.....	3.14	3.21	3.15
Newark-Jersey City.....	2.97	3.10	3.16
New York City.....	3.26	3.29	3.21
Philadelphia.....	2.95	3.02	3.05
Pittsburgh.....	2.99	3.46	3.35
Portland, Oreg.....	3.37	3.45	3.43
St. Louis.....	3.42	.....	3.65
San Francisco-Oakland.....	.....	3.80	.....
Worcester.....	2.94	2.94	3.06



Experienced tool and die maker gives die construction pointers to apprentice.

more precise handwork. Tool and die makers use almost every type of machine tool and precision-measuring instrument. They work with all metals and alloys commonly used in manufacturing and must be familiar with the machining properties of these various metals.

### Where Employed

The largest numbers of tool and die makers are employed in plants producing manufacturing, construction, and farm machinery and equipment. The automobile, aircraft, and other transportation equipment industries also employ large numbers of tool and die makers. Several thousand of these craftsmen work in small tool and die jobbing shops, making tools, dies, and

other machine tool accessories for use in metalworking factories. Companies manufacturing electrical machinery and fabricated metal products are other important employers of tool and die makers. Many nonmetalworking industries also employ tool and die makers.

### Training, Other Qualifications, and Advancement

Tool and die making requires several years of varied training and experience which can be obtained through formal apprenticeship or equivalent on-the-job training. Since this work is highly skilled, persons planning to enter the trade should have a good working knowledge of mathematics and physics as well as

considerable mechanical ability, finger dexterity, and a liking for very precise work. In selecting apprentices, most employers prefer young men who have high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their abilities in 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 shop training, the apprentice learns to operate major machine tools, such as lathes and milling machines. He learns to use handtools in fitting and assembling tools, gages, and other mechanical equipment. Tool and die maker apprentices study heat treating and other metalworking processes. Classroom training in shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading also is given to apprentices. After apprenticeship, several years' experience often is necessary to qualify for more difficult tool and die work. Some companies have separate apprenticeship programs for tool-making and die making.

Many metal machining workers have become tool and die makers without completing formal apprenticeships. After acquiring years of experience as skilled machine tool operators or as machinists plus vocational or correspondence school training, these men have developed into all-round workers who can skillfully perform almost any metal machining operation, including tool and die making.

The increasing complexity of modern machinery and metalworking equipment is raising the technical 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 advance their careers.

An early investment in thorough training for this occupation may lead to better paying jobs in the future.



Men who have had tool and die training often advance to supervisory and administrative positions in industry. Many tool and die makers become tool designers. Some open their own tool and die shops.

**Employment Outlook**

Employment of tool and die makers is expected to increase slowly during the remainder of the 1960's and throughout the 1970's, as a result of the anticipated expansion of metal-working activity. (See discussion, p. 386.) Many openings will also become available as experienced tool and die makers transfer to other fields of work, retire, or die. Retirements and deaths alone should provide more than 3,000 job openings annually.

The anticipated long-range expansion in the machinery, electrical equipment, transportation equipment, and other metal-working industries will result in a continued increase in the employment of tool and die makers. Their skills will be needed to make the tools and dies used to produce the large numbers of identical metal parts required in these industries. They will also be needed to help put many technological developments into effect. However, numerically controlled machining operations require fewer of the special tools and jigs and fixtures that are now made by tool and die makers. In addition, numerically controlled machines could replace many of the conventional machines now used in manufacturing tools, jigs, and fixtures, thus increasing output per tool and die maker. (See p. 387 for a discussion of numerical control and other technological changes.)

**Earnings and Working Conditions**

Tool and die makers are among the highest paid machining workers.

Those employed in various manufacturing industries in 84 metropolitan areas surveyed in 1965-66 were paid average straight-time hourly

earnings ranging from \$2.87 in Portland, Maine, to \$4.16 in San Francisco-Oakland, Calif. Straight-time hourly earnings of tool and die makers employed in the following cities were:

Atlanta -----	\$3.60
Birmingham -----	3.25
Boston -----	3.40
Buffalo -----	3.64
Chicago -----	3.84
Cleveland -----	3.66
Dallas -----	3.29
Detroit -----	3.90
Houston -----	3.39
Los Angeles-Long Beach-----	3.62
Milwaukee -----	3.93
Minneapolis-St. Paul-----	3.64
Newark-Jersey City-----	3.59
New York City-----	3.51
Philadelphia -----	3.49
St. Louis -----	3.82
San Francisco-Oakland-----	4.16

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 that can be acquired only after many years of experience. For this reason, companies are reluctant to lay off tool and die makers, even when production is decreased. Furthermore, tool and die makers have greater occupational mobility than other workers. They can transfer to jobs as instrument makers or machinists, or find jobs in other industries.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

**INSTRUMENT MAKERS  
(MECHANICAL)**

(D.O.T. 600.280)

**Nature of Work**

The increasing use of instruments in production, research, development, and testing work in industry and Government, is making the job of the

instrument maker increasingly important. Instrument makers (also called experimental machinists and modelmakers) work closely with engineers and scientists in translating designs and ideas into experimental models, special laboratory equipment, and custom instruments. They also modify existing instruments for special purposes. Experimental devices constructed by these craftsmen are used, for example, to regulate heat, measure distance, record earthquakes, and control industrial processes. The mechanical instrument parts and models made by these workers range from simple gears to intricate parts of navigation systems used in guided missiles. Some instrument makers (who are not discussed in this brief) specialize in installing electric and electronic instrument components.

Instrument makers fabricate metal parts by operating machine tools such as lathes and milling machines, and by using handtools such as files and chisels. Because accuracy is important, they measure finished parts with a wide variety of precision-measuring equipment, including micrometers, verniers, calipers, profilometers, and dial indicators, as well as standard optical measuring instruments.

Instrument makers work from rough sketches, verbal instructions, or ideas, as well as detailed blueprints. Thus, in making parts, they frequently use considerable imagination



Instrument maker uses ultrasonic machine tool.

and ingenuity. Instrument makers sometimes work on parts that must not vary from specifications by more than ten millionths of an inch. To meet these standards, they commonly use special equipment or precision devices, such as the electronic height gage, which are used only infrequently by other machining workers. They also work with a variety of materials, including plastics and rare metals such as titanium, tantalum, and rhodium.

An instrument maker may construct instruments from start to finish—making and assembling all the parts and testing finished instruments for proper operation. However, in large shops or where electrical or electronic components are to be incorporated into an instrument, they frequently work with other instrument makers, such as electronic specialists, each making a part of a complicated instrument.

Because they usually work on their own and have highly developed manual skills and reasoning abilities, instrument makers have considerable prestige among their fellow employees.

### Where Employed

Many instrument makers are employed by firms which manufacture instruments. Research and development laboratories also employ instrument makers to make the special devices required in scientific research. The Federal Government employed about 2,000 instrument makers in early 1967.

The main centers of instrument making are located in and around a few large cities, particularly New York City, Chicago, Los Angeles, Boston, Philadelphia, Washington, D.C., and Detroit.

### Training, Other Qualifications, and Advancement

Some 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, usually need at least 1 or 2 years of instrument shop experience to qualify as instrument makers.

Most instrument makers learn their trade through instrument-maker apprenticeships which generally last 4 or 5 years. A typical 4-year instrument maker apprenticeship program consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. 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, blueprint reading, chemistry, electronics, and fundamental instrument design. 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.

For apprenticeship programs, 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 desirable, and may make possible future promotions to technician positions.

A person 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. He must have initiative and resourcefulness because instrument makers often work alone and almost always under minimum or no supervision. Since the instrument maker often faces new problems, 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 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 work.

As the instrument maker's skill improves and as he broadens his knowledge, he may advance to increasingly responsible positions. Up to 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, they 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 increase rapidly during the remainder of the 1960's and throughout the 1970's, as a result of anticipated expansion of metalworking activities. (See discussion, p. 386) and the growing use of instruments in manufacturing processes and research and development work. However, this is a relatively small occupation and the number of openings resulting from employment growth in any one year will be small. In addition to employment growth, several hundred job openings annually are expected to result from the need to replace experienced workers who transfer to other occupations, retire, or die.

Growing numbers of instrument makers will be needed to make models of new instruments that may be mass-produced in the future, and also to make custom or special purpose instruments that are not needed in large numbers. Many devices made by these craftsmen will be needed in the ex-

panding fields of nuclear energy and industrial automation. Also, many new precision instruments, which will be even more versatile and sensitive than those in current use, can be expected to emerge from growing research and development programs of universities, Government agencies, private laboratories, and manufacturing firms. New instruments are needed to solve many technical and scientific problems. For example, scientists who work with atomic reactors need better control systems for handling radioactive materials, as well as improved "thermometers" that can measure temperatures in the millions of degrees.

**Earnings and Working Conditions**

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. Instrument makers employed by the Federal Government received straight-time hourly earnings in selected areas in early 1967, as follows:

Atlanta -----	\$3. 09-\$3. 95
Birmingham -----	3. 06- 3. 89
Boston -----	3. 10- 3. 91
Chicago -----	3. 35- 4. 15
Cleveland -----	3. 21- 4. 07
Denver -----	3. 12- 3. 83
Detroit -----	3. 28- 4. 45
Hartford -----	2. 98- 3. 61
Jacksonville -----	2. 93- 3. 74
Los Angeles-Long Beach---	3. 28- 4. 14
New York -----	3. 30- 3. 98
Philadelphia -----	3. 10- 3. 83
San Francisco-Oakland---	3. 44- 4. 56
Washington, D.C-----	3. 11- 4. 26

These wage rates are generally comparable to those paid by private industry in the same locality.

Instrument shops usually are clean and well lighted. Room temperatures usually are controlled in shops where precision measuring instruments are used. Instrument assembly rooms are usually clean, and are sometimes known as "White Rooms," where almost sterile conditions are maintained.

Serious work accidents are not common, 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.

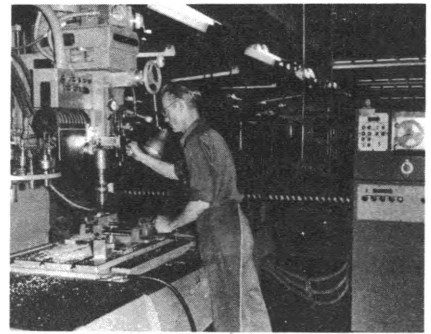
See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

**SETUP MEN (MACHINE TOOLS)**

(D.O.T. 600.380; 604.280 and .380; 605.380; and 619.380)

**Nature of Work**

The setup man, often called a machine tool job setter, is a skilled specialist employed in plant and machine shops that do machining in large volume. His main job is to set up machine tools—that is, to get machine tools ready for use by semiskilled operators. He may also explain to these workers the operations to be performed, and show them how to check the accuracy of their work. Usually a setup man is assigned a number of machine tools, which often are one type, such as current lathes. However, he may set up several different machine tools such as milling machines and automatic screw machines. Working from drawings, blueprints, written specifications, or job layouts, he determines the rate at which the material is to be fed into the machines, operating speeds, tooling, and operation sequence. He then selects and installs the proper cutting or other tools and adjusts guides, stops, and other controls. He may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned



Setup man adjusts tape controlled drilling machine.

over to a semiskilled operator. The setup man may make additional adjustments later to maintain accurate production.

**Where Employed**

Most setup men are employed in factories that manufacture fabricated metal products, transportation equipment, and machinery. These workers usually are employed by large companies that employ many semiskilled machine tool operators. They usually are not employed in maintenance shops or in small jobbing shops.

**Training and Other Qualifications**

To become a setup man, a worker usually must qualify as an all-round machinist or skilled machine tool operator. A setup man must be thoroughly trained in the operation of one or more machine tools. He must read blueprints and make computations in selecting speeds and feeds for machine tools. The ability to communicate clearly is important since he must explain to a semiskilled machine tool operator how to perform machining operations and how to check machining accuracy. Above all, a setup man must be skilled in selecting the sequence of operations so that metal parts will be made exactly to specifications. Openings for setup men usu-

ally are filled from within a shop by promotion or reassignment.

### Employment Outlook

Employment of setup men is expected to increase moderately during the remainder of the 1960's and throughout the 1970's, as a result of the anticipated expansion of metal working activities.

The demand for setup men is expected to increase slower than the increase in demand for machined products. The use of numerically controlled machine tools may change the duties of setup men. In the future, setup men may only preset tools, instruct operators, and check the first few parts that are produced. Since setup men are skilled workers, their changes for advancement or transfer into other jobs will remain good.

### Earnings and Working Conditions

The earnings of setup men compare favorably with those of other skilled factory workers. In a survey of the machinery manufacturing industry in 21 metropolitan areas in mid-1966, setup men had average straight-time hourly earnings in selected areas as follows:

Boston .....	\$3.19
Chicago .....	3.22
Cleveland .....	3.33
Detroit .....	3.57
Hartford-New Britain-Bristol.....	3.04
Los Angeles-Long Beach.....	3.18
Minneapolis-St. Paul.....	2.92
Philadelphia .....	3.06
St. Louis .....	3.36

Good safety habits are important since the setup man must handle sharp-cutting tools. He may also be exposed to high speed machine tools which have sharp-cutting instruments when he makes the trial runs to test the accuracy of the setup.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

## LAYOUT MEN

(D.O.T. 600.381)

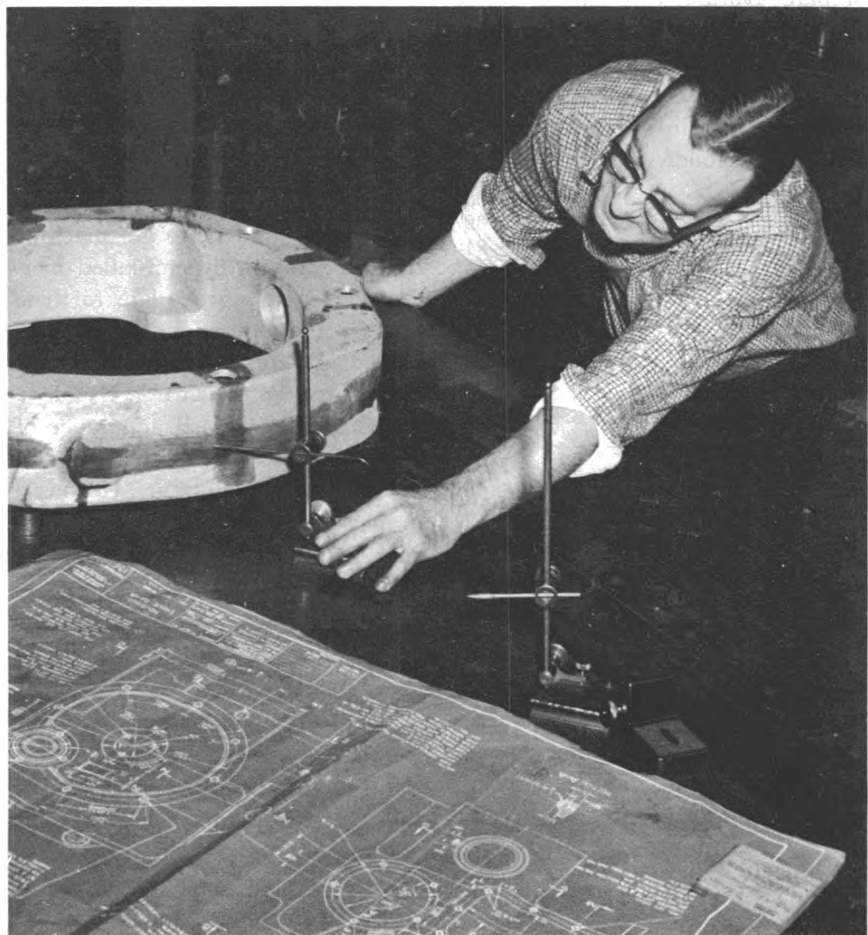
### Nature of Work

The layout man is a highly skilled specialist who marks metal castings, forgings, or metal stock to indicate where and how much machining is needed. His work enables other workers to use machine tools simply by following his lines, points, and other instructions. He uses many instruments, such as the scribe, 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 key-seat or box rule, for drawing lines and laying off distances on curved sur-

faces; dividers, for transferring and comparing distances; L- or T-squares for determining right angles; and height gages, 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 capabilities of standard machine tools.

### Where Employed

Layout men work primarily in the mass production metalworking industries employing large numbers of machine tool operators. Most layout men work in plants producing fabricated metal products, machinery, and transportation equipment. Their skills are generally called into use when a relatively small number of a particular item is required.



Layout man uses surface gage to mark lines and reference points for machine tool operator.

### **Training, and Other Qualifications**

From 6 to 10 years' training and experience are needed to develop the skill for this occupation. Required training includes a machinist apprenticeship, or an equivalent knowledge of machine tools, machining qualities of metals, and the proper sequence of machining operations. Layout men must learn to visualize the sequence of machining operations so they can correctly prepare detailed work plans for less skilled workers. A layout man must be well trained in mathematics and blueprint reading and be able to use various precision-measuring tools. Mechanical ability and a liking for very precise work are other important qualifications for layout men.

The ability to communicate clearly is very important since the layout man

must be able to understand detailed information from a designer or engineer and instruct a machine tool operator on how to perform the actual machining.

### **Employment Outlook**

Employment of layout men is expected to increase slowly during the remainder of the 1960's and throughout the 1970's, as a result of the anticipated expansion of metalworking activities. (See discussion, p. 386.) Most of the employment increase will be in plants employing large numbers of machine tool operators. Because this is a small occupation, only a few hundred job openings annually are expected to result from both employment growth and the need to replace

experienced layout men who transfer to other occupations, retire, or die.

The increasing use of numerically controlled machine tools is a major factor that is expected to limit employment growth in this occupation. (See discussion, p. 387.) However, correct positioning of metal stock and tools will continue to be important, and layout men will be needed to mark accurate reference points. In addition, layout men can easily transfer to other work such as machine programming, which will become more important with further technological development.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

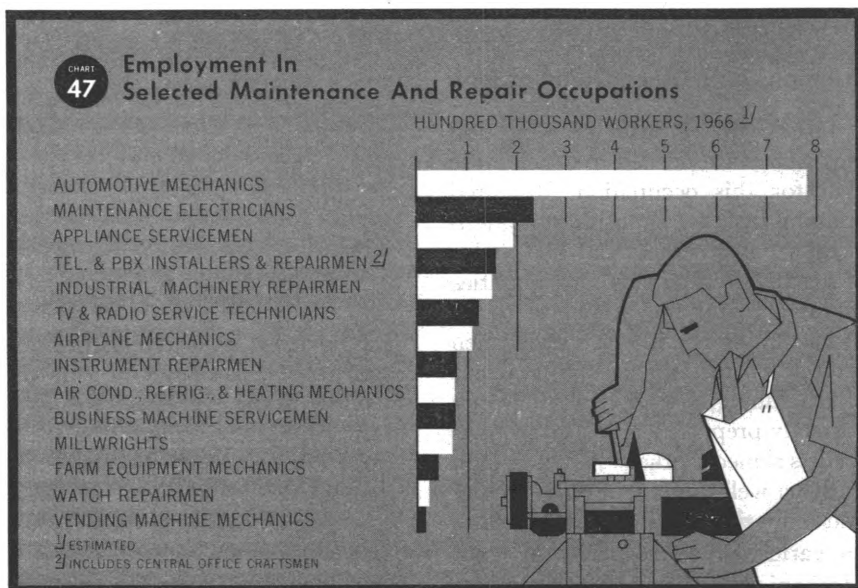
## MECHANICS AND REPAIRMEN

Mechanics and repairmen—the skilled workers who keep our automobiles, airplanes, industrial machinery, household appliances, and similar equipment operating properly—make up one of the fastest growing occupational groups in the Nation's labor force. This occupational field offers a variety of career opportunities to young men who are mechanically inclined and are willing to invest a few years in learning a trade.

Employment of mechanics and repairmen totaled 2.4 million in 1966. Almost one-third (785,000) of these were automotive mechanics, such as automobile mechanics, truck or bus mechanics, and automobile body repairmen. Other large occupations—each employing more than 100,000 workers—were appliance servicemen, industrial machinery repairmen, television and radio service technicians, and aircraft mechanics. (See Chart 47.) Employment in some occupations, including vending machine mechanic, electric sign serviceman, bowling-pin-machine mechanic and X-ray equipment serviceman, was relatively small.

In addition to the 2.4 million mechanics and repairmen employed in 1966, about 500,000 workers were employed in four mechanics and repairmen related occupations: Maintenance electrician, telephone repairman, millwright, and watch repairman. Altogether, these 2.9 million maintenance and repair workers represented about 3 out of every 10 skilled workers.

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About 30 percent of the mechanics and repairmen were employed in manufacturing industries, and the majority of these were employed in plants that produce durable goods such as transportation equipment, machinery, primary metals, and fabricated metal products. Another 20 percent of the mechanics and repairmen were employed in retail trade—mainly by firms that sell and service automobiles, household appliances, farm equipment, and other mechanical equipment. Approximately 15 percent were employed in shops that specialize in servicing such equipment. Most of the remaining mechanics and repairmen were employed in the transportation, construction, and public utilities industries, and by Government at all levels.

Most employment opportunities for mechanics and repairmen occur in the more populous and industrialized States. About half of them work in eight states: California, New York, Pennsylvania, Ohio, Illinois, Texas, Michigan, and New Jersey.

### Training, Other Qualifications, and Advancement

Many mechanics and repairmen learn their skills on the job or through apprenticeship. Some acquire their

basic training in vocational and technical schools, or attend such schools to increase their skills. Others qualify by taking correspondence courses. Training and experience in the armed services also may help young men prepare for occupations such as aircraft mechanic and television and radio serviceman.

Many employers consider a formal apprentice training program to be the best way to learn skilled maintenance and repair work. An apprenticeship consists of 3 to 6 years of paid on-the-job training, supplemented each year by at least 144 hours of related classroom instruction. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Employers look for applicants who have mechanical aptitude and manual dexterity. Many employers prefer people whose hobbies or interests include automobile repair, model building, or radio and television repair. A high school education is often required for employment. Employers also favor applicants who have had courses in mathematics, chemistry, physics, blueprint reading, and machine shop. Generally, apprentice applicants and other trainees are required to be at least 18 years old and in good health.

Physical requirements for work in this field vary greatly. For example, a millwright should be strong and agile since he may need to climb ladders, lift heavy equipment, and work in awkward positions in cramped spaces. On the other hand, instrument and watch repairmen need patience, finger dexterity, and good vision. Persons with certain physical handicaps can repair watches.

Workers in most maintenance and repair occupations have several avenues of advancement. Some move into supervisory positions, such as foreman, maintenance manager, or service manager. Specialized training prepares others to advance to sales, teaching, technical writing, and technician jobs. Substantial numbers of servicemen have opened their own businesses.

### Employment Outlook

Employment in maintenance and repair occupations as a whole is expected to increase rapidly through the rest of the 1960's and over the 1970's. Job openings resulting from both employment growth and deaths and retirements are expected to average more than 160,000 a year during this period. Additional job openings will result as experienced workers transfer to other occupations. Automotive mechanics, appliance servicemen, maintenance electricians, aircraft mechanics, television and radio service technicians, and instrument repairmen will find many employment opportunities.

Many factors are expected to contribute to the growing demand for mechanics and repairmen. The anticipated rise in expenditures for new plant and equipment will result in more mechanization and the use of more complex machinery and equipment in many industries. Greater research and development expenditures probably will yield new and, in many cases, more complex products for use by industry and consumers. Growing numbers of households and higher

levels of personal spendable income will contribute to an increased demand for household appliances, automobiles, lawnmowers, boats, and other items that mechanics and repairmen service.

In the future, applicants for maintenance and repair jobs will have to meet higher standards of performance to maintain and repair the increasingly complex equipment coming into general use. Young men who acquire a good basic education (including courses in mathematics and science), as well as thorough job training, will be better prepared than other applicants to compete for the higher paying jobs that are likely to be available.

This chapter includes statements on the following maintenance and repair workers: Air-conditioning, refrigeration, and heating mechanics; appliance servicemen; bowling-pin-machine mechanics; automobile body repairmen; automobile mechanics; business machine servicemen; diesel mechanics; electric sign servicemen; farm equipment mechanics; industrial machinery repairmen; instrument repairmen; maintenance electricians; millwrights; television and radio service technicians; truck and bus mechanics; vending machine mechanics; and watch repairmen. Other maintenance and repair workers are discussed in other chapters in the *Handbook*. For example, aircraft mechanics are discussed in Civil Aviation Occupations and telephone and PBX installers and repairmen in Occupations in the Telephone Industry.

### AIR-CONDITIONING, REFRIGERATION, AND HEATING MECHANICS

(D.O.T. 637.281 and .381; 862.281 and .381; and 869.281)

#### Nature of Work

Air-conditioning, refrigeration, and heating mechanics work on the cool-

ing and heating equipment used in homes, offices, schools, and other buildings. The major occupations in this field are air-conditioning and refrigeration mechanics, furnace installers, oil burner mechanics, and gas burner mechanics. Although these are distinct trades, many workers are skilled in, and frequently do the work of, two of these trades or more. (This statement does not cover mechanics who work on railroad, truck, automotive, or marine air-conditioning and refrigeration equipment.)

*Air-conditioning and refrigeration mechanics* (D.O.T. 637.281 and .381) work on equipment ranging in size from small window air-conditioners to large central-plant type air-conditioning or refrigeration systems. In installing new equipment, the mechanic puts the motors, compressors, or absorption equipment, evaporators and other components in place, following blueprints and design specifications. He connects duct work, refrigerant lines, and other piping, and then connects the equipment to an electrical power source. After completing the installation, he charges the system with refrigerant and checks it for proper operation.

When air-conditioning and refrigeration equipment breaks down, the mechanic diagnoses the cause and makes the necessary repairs. In looking for defects, he may inspect components such as relays, thermostats, motors, and refrigerant lines. An air-conditioning and refrigeration mechanic uses a variety of tools and equipment, including electric drills, pipe cutters and benders, acetylene torches, and testing devices such as psychrometers, refrigerant gauges, vacuum gauges, and ammeters.

*Furnace installers* (D.O.T. 862.381 and 869.281) install oil, gas, and electric heating units, following blueprints or other specifications. After setting the heating unit in place, they install fuel pipes, air ducts, blowers, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.



Manufacturer's service representative instructs mechanic in maintenance of refrigeration controls.

*Oil burner mechanics* (D.O.T. 862.281) keep oil-fueled heating systems in good working order. During the fall and winter, they spend most of their time repairing and adjusting oil burners. The mechanic determines the reason a burner is not operating properly by checking the thermostat, burner nozzles, controls, and other parts. He uses various types of testing equipment to locate the cause of the trouble. The mechanic may carry a large stock of replacement parts in his truck, so that he can make repairs in the customer's home or business. However, if major repairs are necessary, he may have to do the work in the repair shop. During the summer, the mechanic may spend much of his time replacing air filters and vacuum cleaning vents, ducts, and other parts of the heating system which accumulate soot and ash.

*Gas burner mechanics* (D.O.T. 637.281), also called gas appliance servicemen, have duties similar to those of oil burner mechanics. They diagnose malfunctions in gas-fueled heating systems and make the necessary repairs and adjustments. They may also repair cooking stoves, clothes dryers, and hot water heaters. During summer months, gas burner mechanics employed by gas utility companies may spend much of their

time in the shop inspecting and repairing gas meters.

Furnace installers, oil burner mechanics, and gas burner mechanics use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches. They also use testing devices such as vacuum gauges, volt meters, air velocity meters, and electronic circuit testers.

Cooling and heating systems may be installed or repaired by craftsmen other than the mechanics discussed here. For example, on a large air-conditioning installation job, especially where workers are covered by union-management contracts, the duct work might be done by sheet-metal workers; the electrical work by electricians; and the installation of piping, condensers, and other components by pipefitters. Appliance servicemen often install and repair window air-conditioners. (Additional information about appliance servicemen appears elsewhere in the *Handbook*.)

### Where Employed

An estimated 80,000 air-conditioning, refrigeration and heating mechanics were employed in early 1967. Major employers of these workers were: Dealers and contractors that specialized in selling and servicing cooling and heating equipment; construction companies; fuel oil dealers; and gas utility companies. Air-conditioning and refrigeration mechanics, as well as furnace installers, were employed primarily by cooling and heating dealers and contractors. Fuel oil dealers employ most oil burner mechanics; gas utility companies employ most gas burner mechanics.

Air-conditioning and refrigeration mechanics, and furnace installers are employed in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. The employment of oil burner mechanics is concentrated in States where oil is a major heating fuel. About half of these workers are employed in New York, Massachusetts, Pennsylvania, New

Jersey, and Illinois. Similarly, the employment of gas burner mechanics is concentrated in States where gas is a major heating fuel. About half of these workers are employed in California, Ohio, Illinois, Michigan, Pennsylvania, and New York.

### Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration and heating mechanics start as helpers and acquire the skills of their trade informally by working for several years with experienced craftsmen. Usually, the beginners' work consists of lifting, loading, cleaning up, and performing relatively simple jobs such as insulating refrigerant lines or cleaning furnaces. As trainees gain experience, they are given progressively more complicated tasks such as installing pumps and burners and checking electrical circuits. A growing number of employers prefer on-the-job trainees to be high school graduates who have had courses in mathematics, physics, and blueprint reading.

Many high schools and vocational schools, in cooperation with local employers and such organizations as the Air-Conditioning and Refrigeration Institute, and the National Oil Fuel Institute, offer courses designed to prepare students for entry jobs as air-conditioning and refrigeration mechanics or oil burner mechanics. These courses, which may last from 2 to 3 years, consist of shop training in manual skills and classroom instruction in air-conditioning, refrigeration, and heating theory and related subjects. Additional on-the-job training and work experience can qualify these students as mechanics.

Apprenticeship programs for the pipefitter, electrician, and sheet-metal worker often include training in air conditioning, refrigeration, and heating work. Journeymen in these trades often specialize in installing and maintaining air-conditioning, refrigeration, and heating equipment. Additional information about these



trades appears elsewhere in the *Handbook*.

Mechanical aptitude and an interest in electricity are important qualifications for air-conditioning, refrigeration, and heating mechanics. Good physical condition is also important, because mechanics are often required to lift and move heavy equipment.

### Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase rapidly during the next decade. In addition to the anticipated employment growth, more than 1,200 job openings will arise annually from the need to replace experienced mechanics who retire or die. Openings will also occur as experienced mechanics transfer to other types of work.

Most new job openings will be for air-conditioning and refrigeration mechanics. The number of homes with central air conditioning tripled between 1960 and 1965. Anticipated increases in household formations and rising personal incomes point to continued rapid growth in home air-conditioning. The use of air conditioning in offices, stores, hospitals, schools, and other nonresidential buildings is also expected to increase. In addition, more refrigeration equipment will be needed in the production, storage, and marketing of food and other perishables.

Employment of furnace installers and gas burner mechanics is expected to follow the rapid growth trends in the construction of homes and businesses. However, these workers may face slight competition for jobs as a result of the small but rapidly growing number of electrically heated homes and businesses. Electric heating systems are usually installed and serviced by electricians.

Employment of oil burner mechanics is expected to remain fairly stable during the next decade, since rela-

tively few new homes are being built with oil heating systems. Nevertheless, employment opportunities for oil heating mechanics will occur as experienced mechanics retire, die, or transfer to other fields of work.

### Earnings and Working Conditions

Earnings data for air-conditioning, refrigeration and heating mechanics are not available on a national basis. Information obtained from several employers in late 1966, however, indicated that beginning rates for helpers ranged from about \$1.50 to \$2.25 per hour, and the top rates for mechanics ranged from about \$3.00 to \$5.00 per hour. The rates of pay for helpers and mechanics depended on factors such as level of skill, type of equipment worked on, and geographic area. For example, mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only 1 of the 2.

Most mechanics work a 40-hour week. However, during seasonal peaks they often work overtime or irregular hours. Air-conditioning and refrigeration mechanics are busiest during spring and summer. Oil burner mechanics and gas burner mechanics are busiest during fall and winter. Most employers try to provide their mechanics with a full workweek the year round, but they may have to reduce their hours of work or layoff some of them when the seasonal peaks end. However, employment in most shops that install and service both air-conditioning and heating equipment is fairly stable throughout the year.

Mechanics are sometimes required to work at great heights when installing new equipment. They also may work in awkward or cramped positions in order to reach motors or other parts of the equipment they are repairing. Common hazards in this trade include electrical shock and torch burns, and muscle strains and other injuries that may result from handling heavy equipment.

### Where To Go for More Information

A young person who wishes to obtain further information about employment opportunities for air-conditioning, refrigeration, and heating mechanics, should contact the local office of the State employment service, as well as firms that employ these workers. The State employment service also may be a source of information about training opportunities available under the Manpower Development and Training Act, and various apprenticeship, and other programs.

Information about advanced training in air-conditioning and refrigeration may be obtained from the Refrigeration Service Engineers Society, 433 North Waller Ave., Chicago, Ill. 60644.

Information about oil heating systems training may be obtained from the Education Department, National Oil Fuel Institute, 60 East 42nd St., New York, N.Y. 10017, or its local or State organizations.

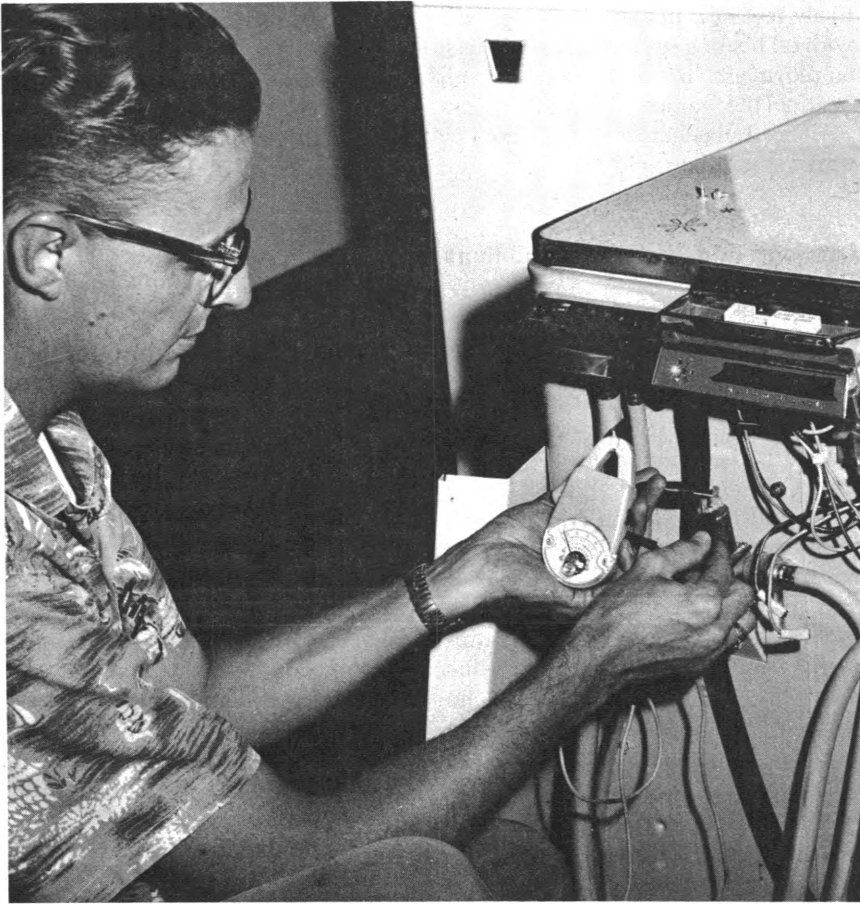
General information about gas burner mechanics may be obtained from the American Gas Association, Inc., 605 Third Ave., New York, N.Y. 10016.

## APPLIANCE SERVICEMEN

(D.O.T. 723.381)

### Nature of Work

Electric and gas appliances that do not operate properly are repaired by appliance servicemen. These appliances range from small, relatively uncomplicated appliances, such as toasters and irons, to refrigerators and washing machines, which may have complex control systems. Basically, appliance repair work involves determining why appliances do not operate properly and then installing new parts, repairing parts, or making ad-



Serviceman tests electrical circuits of dishwasher.

justments. Appliance servicemen usually specialize in the repair of electrical or gas appliances, or a particular type of appliance, such as washing machines, refrigerators, or clothes dryers. Some servicemen repair only small appliances, such as toasters, coffee makers, and food mixers.

To determine why an appliance is not working properly, servicemen ask customers how the appliance operated when it was last used. If possible, they may operate an appliance to detect unusual noises; overheating; excess vibration; and broken, worn, or loose parts. Servicemen also look for common sources of trouble, such as faulty gas, electric, and fluid lines and connections. To check electric and gas systems, they use special tools and testing devices, including ammeters, ohmmeters, voltmeters and manome-

ters, combustion test equipment, and vacuum and pressure gages.

After the servicemen find what is wrong with an appliance, they make the necessary repairs and adjustments. Frequently, this work involves replacing parts that receive extra wear, such as electric cords on small appliances, or cleaning parts, such as the lint filters found in clothes dryers. In removing old parts and installing new ones, servicemen use common handtools, including screwdrivers and pliers, and may use special wrenches and other handtools designed for use on particular appliances.

Most repairs to refrigerators and other large appliances usually are made in the customers' homes. However, if major repairs are necessary, the appliance is removed to a repair shop or, in some cases, to the manufacturer. Small appliances usually are

brought to a repair shop by the customers.

An important part of the work of most appliance servicemen is dealing personally with customers. For example, they answer customers' questions and complaints about appliances and frequently advise customers about the care and use of their appliances, because many breakdowns are caused by improper use. They may remind housewives about the proper loading of automatic washing machines or how to stack dishes in dishwashers.

Appliance servicemen have considerable variety in their work. They may drive light trucks or automobiles, some equipped with two-way radios. They may give estimates to customers on the cost of repair jobs, and usually keep records of parts used and hours worked on each repair job. Some servicemen order parts and sell new or used appliances.

### Where Employed

An estimated 200,000 appliance servicemen were employed throughout the country in early 1967. More than half of these servicemen owned or were employed by independent repair shops and firms that specialize in servicing coin-operated washing and drycleaning machines. About a fourth were employed in service centers of retail establishments such as department and appliance stores. The remainder were employed in service centers operated by appliance manufacturers and wholesale distributors of appliances and by gas and electric utility companies.

Appliance servicemen are employed in almost every community. Most servicemen, however, are employed in the highly populated States and major metropolitan areas.

### Training, Other Qualifications, and Advancement

Appliance servicemen usually are hired as helpers and acquire their skills through on-the-job training and

work experience. Inexperienced men are given relatively simple work assignments. In some companies, they work for the first few months helping to install appliances in customers' homes, driving service trucks, and learning street locations. In other companies, they begin to learn the skills of appliance servicemen by working in the shop, where they re-build used parts such as washing machine transmissions. Gradually, trainees learn how motors, gears, and other appliance parts operate. They progress from simple repair jobs, such as replacing a switch, to more difficult jobs, such as adjusting automatic washing machine controls. In addition to practical experience on the job, trainees frequently receive classroom instruction given by appliance manufacturers and local distributors. Many trainees take correspondence courses in basic electricity and electronics or attend technical schools to increase their skills in appliance repair.

Trainees usually are supervised closely for 6 to 12 months. By this time, most gas-appliance servicemen can repair several kinds of appliances on their own, and they may be given responsibility for their own service trucks and for appliance parts and tools. Electrical-appliance servicemen usually need up to 3 years' on-the-job experience to become fully qualified. Many experienced servicemen attend training classes (often on company time) and study service manuals to become familiar with new appliances and the best ways to repair them.

Programs to train unemployed and underemployed workers for entry jobs in the appliance service field were operating in many cities in 1967 under the Manpower Development and Training Act. These programs lasted from several weeks to a year; most lasted longer than 5 months. With additional training and experience, graduates of these programs eventually may become skilled servicemen.

Employers look for applicants with mechanical aptitude, particularly

those who are high school graduates and who have had high school or vocational school courses in electricity, mathematics, and physics. They must understand, in a practical way, how to use equipment that measures electricity and how to use such measurements to determine whether electrical currents in appliances are flowing properly. Also important in servicing electrical appliances is a knowledge of wiring diagrams, which show electrical connections and current flow between appliance parts. A knowledge of electronics is necessary to perform some appliance repair jobs.

Appliance servicemen who work in large repair shops or service centers and who show technical proficiency can be promoted to foreman, assistant service manager, or service manager. Preference is given to men who also have shown ability to get along well with other servicemen and with customers. A general knowledge of bookkeeping and other subjects related to managing a business is helpful. Because of their experience in repairing appliances and dealing with customers, appliance servicemen often become successful appliance salesmen. Experienced servicemen who have sufficient funds also may open their own sales or repair shops.

Servicemen who work for appliance manufacturers can become instructors, teaching servicemen to repair new models of appliances, or technical writers, preparing service manuals. Some servicemen may advance to managerial positions, such as regional or national service or parts manager.

### Employment Outlook

Employment of appliance servicemen is expected to grow rapidly through the 1970's. In addition to the many thousands of job opportunities resulting from employment growth, about 4,000 openings each year will stem from the need to replace experienced servicemen who retire or die. Transfers of servicemen

to other kinds of work will provide still additional job openings.

The number of household appliances in use is expected to increase rapidly during the 1970's. Factors that will contribute to this growth include rising population and family formations, and rising levels of personal disposable income. The demand for appliances also will be stimulated by the introduction of new appliances, some of which may be cordless like many automatic toothbrushes now in use, and by the improved styling and design of appliances to make them attractive and easy to operate. In addition, more widespread use of such appliances as electric can openers, waste disposers, home clothes dryers, knife sharpeners, and coin-operated dry cleaning machines is expected.

Employment of appliance servicemen is not expected to increase as rapidly as the number of appliances that will be in use. Although the automatic operation of some types of appliances has tended to make them more complicated, manufacturers are designing appliances with more durable components, and appliances that can be taken apart and repaired more easily. In addition, employers are increasing the efficiency of servicemen through more widespread and more effective training.

### Earnings and Working Conditions

In late 1966, straight-time average hourly earnings of appliance servicemen generally ranged between \$1.75 and \$4.00. Most experienced servicemen had earnings ranging between \$2.75 and \$3.50 an hour. The wide variation in wage rates for servicemen reflects not only differences in type of employer, but other differences, such as geographical location of the job and the type of equipment serviced. Many appliance servicemen work more than 8 hours a day and receive higher rates of pay for overtime hours. They may also receive commissions for sales leads. Some appliance servicemen receive paid vacations and

sick leave, health insurance, and other benefits, as well as credit toward retirement pensions.

The shops in which appliance servicemen work are relatively quiet, well lighted, and adequately ventilated. While repairing small appliances, servicemen usually sit at benches. Working conditions outside the shop vary considerably. Servicemen sometimes work in narrow spaces, uncomfortable positions, and places that are not clean. Servicemen who work with large appliances may spend several hours a day driving in all kinds of weather between the shops where they work and customers' homes.

Appliance repair work is generally safe, although accidents are possible while the serviceman is driving, handling electrical parts, or lifting or moving large appliances. Inexperienced men are shown how to use tools safely and instructed in simple precautions against electric shock.

The work of appliance servicemen is often performed with little direct supervision. This feature of the job may appeal to many young people.

### Where To Go for More Information

Further information about jobs in the appliance service field may be obtained from local appliance repair shops, appliance dealers, gas and electric utility companies, appliance manufacturers, and local offices of the State employment service. Local vocational schools that offer courses in appliance servicing, electricity, and electronics can provide helpful information about training. The State employment service also may provide information about the Manpower Development and Training Act and other programs that provide training opportunities.

Information about training programs or work opportunities in this field also may be obtained from:

Association of Home Appliance  
Manufacturers,  
20 North Wacker Drive, Chicago, Ill.  
60606.

National Appliance and Radio-TV  
Dealers Association,  
364 Merchandise Mart, Chicago, Ill.  
60654.

## AUTOMOBILE BODY REPAIRMEN

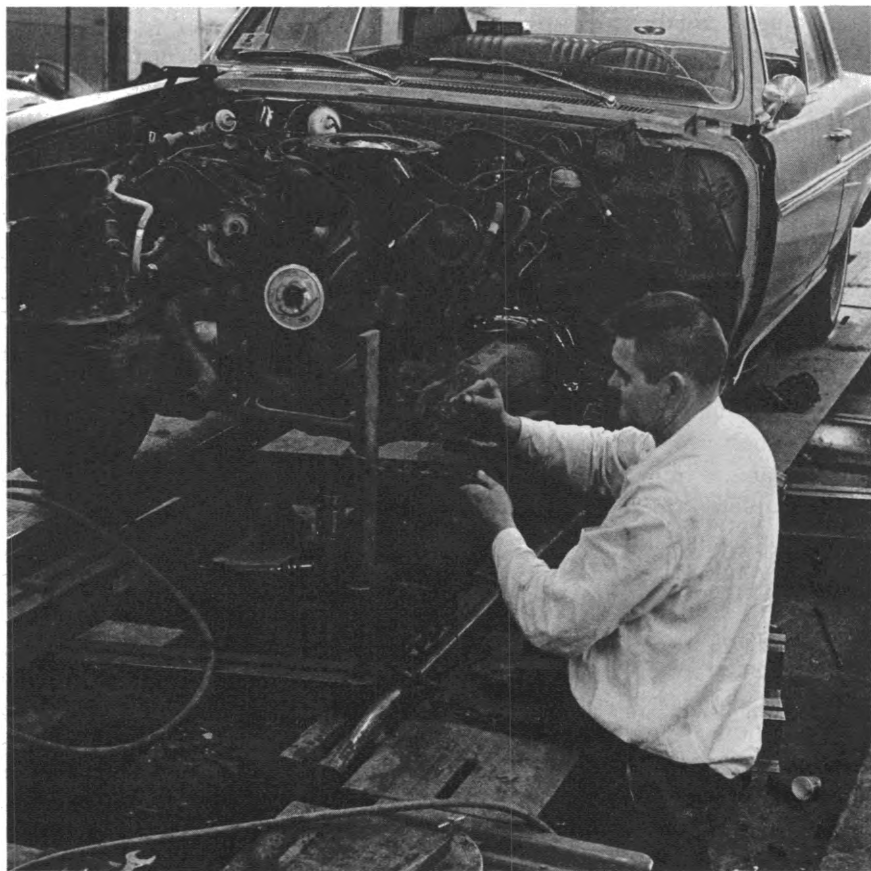
(D.O.T. 807.381)

### Nature of Work

Automobile body repairmen are skilled metal craftsmen who repair motor vehicles damaged in collisions and other accidents. Repair of damaged vehicles may involve such work as straightening bent frames, removing dents from fenders and body panels, welding torn metal, and replacing badly damaged parts. Body repairmen usually are qualified to

repair all types of vehicles, although most work mainly on automobiles and small trucks. Some specialize in repairing large trucks, buses, or truck trailers.

Before making repairs, body repairmen generally receive instructions from their supervisors, who determine which parts are to be restored or replaced, and who estimate the amount of time the repairs should take. When repairing damaged fenders and other body parts, the body repairman may first remove body hardware, window operating equipment, and trim in order to get at the damaged area. In reshaping the metal, he may push large dents out with a hydraulic jack or hand prying bar, or knock them out with a hand tool or pneumatic hammer. He smooths remaining small dents and creases by holding a small anvil against one side of the damaged area while hammering the



Automobile body repairman uses hydraulic machine to straighten damaged frame.

opposite side. Very small pits and dimples are removed from the metal with the aid of pick hammers and punches. The body repairman may remove badly damaged sections of body panels with a pneumatic metal-cutting gun or acetylene torch, and replace them by welding in new sections. If the damage includes tears in the metal, he welds the torn edges. If the metal has been stretched, he shrinks it by repeatedly heating the area with an acetylene torch and striking it with a hammer until the metal's original shape is restored.

The automobile body repairman uses solder to fill small dents that he cannot work out of the metal. Before applying the solder, he cleans the dent and coats it with liquid tin so that the solder will adhere to the surface. He softens the solder with a torch and uses a wooden paddle or other tool to mold it to the desired shape. When the solder has hardened, the body repairman files or grinds it down to the level of the adjacent metal. He may use plastic, rather than solder, for filling small dents.

After the damaged metal has been restored to its original shape, the repaired surfaces are sanded in preparation for painting. In most shops, automobile painters do the painting. (These workers are discussed elsewhere in the *Handbook*.) Some of the smaller shops employ workers who are combination body repairmen and painters.

The automobile body repairman uses special machines to align damaged vehicle frames and body sections. He chains or clamps the machine to the damaged metal and applies hydraulic pressure to straighten it. He also may use special devices to align damaged vehicles that have "unit-bodies" instead of frames. In some shops, the straightening of frames and unit-bodies is done by a body repairman who specializes in this type of work.

The body repairman's work is characterized by variety because the repair of each damaged vehicle presents a different problem. Therefore,

in addition to having a broad knowledge of automobile construction and repair techniques, he also must be able to develop appropriate methods for each repair job. Most body repairmen find their work challenging and take pride in being able to restore badly damaged automobiles.

Automobile body repairmen usually work by themselves with only general directions from foremen. In some shops, they may be assisted by helpers.

### Where Employed

Most of the estimated 97,000 automobile body repairmen employed in late 1966 worked in repair shops that specialize in automobile body repairs and painting, and in the service departments of automobile and truck dealers. Other employers of body repairmen included organizations that maintain their own fleets of motor vehicles, such as trucking companies and buslines, and Federal, State, and local governments. Motor vehicle manufacturers employed a small number of these workers.

Automobile body repairmen can find employment opportunities in every section of the country. About half of them work in the eight States with the largest number of automobiles: California, New York, Pennsylvania, Ohio, Texas, Illinois, Michigan, and New Jersey.

### Training, Other Qualifications, and Advancement

Most automobile body repairmen learn the trade through on-the-job experience. Young men usually start as helpers and pick up the skills of the trade from experienced workers. Helpers begin by assisting body repairmen in such tasks as removing damaged parts, installing repaired parts, and sanding repaired surfaces in preparation for painting. They gradually learn how to remove small dents and make other minor repairs,

and progress to more difficult tasks as they gain experience. Generally, 3 to 4 years of on-the-job training is necessary before a helper can become a fully qualified body repairman.

Although most workers who become automobile body repairmen pick up the skills of the trade informally through on-the-job experience, most training authorities recommend the completion of a 3- or 4-year formal apprenticeship program as the best way for young men to learn this trade. Such programs include both on-the-job and related classroom instruction.

Training programs for unemployed and underemployed workers for entry automobile body repairmen jobs were in operation in early 1965 in many cities, under provisions of the Manpower Development and Training Act. These programs, which in 1966 lasted up to a year, stress the fundamentals of automobile body repair. Men who complete these programs need additional on-the-job or apprenticeship training before they can qualify as skilled body repairmen.

Young men who are interested in becoming automobile body repairmen should be in good physical condition and have good eye-hand coordination. Courses in automobile body repair—offered by a relatively small number of high schools, vocational schools, and private trade schools—provide helpful experience, as do courses in automobile mechanics. Although completion of high school is not generally a requirement for getting an entry job, it is an advantage because many employers believe it indicates that a young man can "finish a job."

Automobile body repairmen usually are required to have their own handtools, but power tools ordinarily are furnished by the employer. Many of these workers have a few hundred dollars invested in tools. Trainees are expected to accumulate tools as they gain experience.

An experienced automobile body repairman with supervisory ability may advance to shop foreman. Many body repairmen open their own shops.

### Employment Outlook

Employment of automobile body repairmen is expected to increase moderately through the 1970's. In addition to the few thousand job openings anticipated to occur annually as a result of employment growth, an estimated 1,500 job openings are expected to result each year from the need to replace experienced body repairmen who retire or die. Job openings will also occur as some body repairmen transfer to other lines of work.

The number of body repairmen is expected to increase primarily as a result of the increasing number of motor vehicles damaged in traffic accidents. This toll is expected to continue to increase as the number of motor vehicles in use grows, even though new and improved highways, driver training courses, added safety features on new vehicles, and stricter law enforcement may slow down the rate of increase.

The favorable employment effect of the rising number of motor vehicle accidents will be somewhat offset by developments that will increase the efficiency of body repairmen. For example, the growing practice of replacing rather than repairing damaged parts, the use of plastics for filling dents, and improved tools will enable these workers to complete jobs in less time.

### Earnings and Working Conditions

Skilled automobile body repairmen employed by automobile dealers had estimated average straight-time hourly earnings of \$4.04 in late 1966. These skilled workers generally earned between two and three times as much as inexperienced helpers and trainees.

Many experienced body repairmen employed by automobile dealers and independent repair shops are paid a percentage—usually about 50 percent—of the labor cost charged to the customer. Under this method, a worker's earnings depend largely on the amount of work he is assigned and

how fast he completes it. Some repairmen are paid a weekly salary plus a commission on jobs completed. Body repairmen employed by trucking companies, buslines, and other organizations that repair their own vehicles usually receive an hourly wage rate. Most body repairmen work 40 to 48 hours a week.

Many employers of body repairmen provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Body repairmen in some shops are furnished with laundered uniforms free of charge.

Automobile body shops are noisy because of the banging of hammers against metal and the whir of power tools. Most shops are well ventilated, but often they are dusty and the odor of paint is noticeable. Body repairmen often work in awkward or cramped positions, and much of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, and injuries from power tools.

Unions organizing automobile body repairmen include the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most of the body repairmen who belong to unions are employed by large automobile dealers and by trucking companies and buslines.

### Where To Go for More Information

For further information regarding work opportunities for automobile body repairmen, inquiries should be directed to local employers, such as automobile body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment serv-

ice also may be a source of information about the Manpower Development and Training Act of 1962, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile body repairmen may be obtained from:

Automotive Service Industry Association,  
168 North Michigan Ave., Chicago,  
Ill. 60601.

Independent Garage Owners of America, Inc.,  
624 South Michigan Ave., Chicago,  
Ill. 60605.

### AUTOMOBILE MECHANICS

(D.O.T. 620.131 through .381, .782, and .885; 721.281 and 825.281)

#### Nature of Work

Automobile mechanics keep the Nation's rising number of automobiles and small trucks and buses in good operating condition. They do preventive maintenance, diagnose breakdowns, and make repairs. (Although truck mechanics, who repair large trucks; bus mechanics, who repair large buses; and automobile body repairmen are sometimes called "automobile mechanics," they are discussed separately in the *Handbook*.)

Preventive maintenance—the systematic examination, adjustment, repair, or replacement of the operating parts of a motor vehicle—is an important responsibility of the automobile mechanic because it is vital to safe and trouble-free driving. When performing maintenance on a car, the mechanic may follow a "checklist" to make sure he examines all important parts of the car. During a periodic maintenance inspection, he may, for example, look for and replace worn parts, such as distributor points; clean, adjust, or replace spark plugs;

adjust the carburetor, brakes, and clutch; and balance the wheels.

When mechanical or electrical troubles develop in a car, the mechanic first obtains a description of the symptoms from the owner. If the cause of the trouble is not immediately evident, he may visually inspect and listen to the motor, or drive the car in order to locate the trouble. He also may use a variety of testing equipment, such as motor analyzers, spark plug testers, compression gages, and electrical test meters. The ability to make an accurate diagnosis in a minimum of time is one of the mechanic's most valuable skills. It requires a thorough knowledge of the functioning of the car as well as analytical ability. Many skilled mechanics consider diagnosing "hard to find troubles" one of their most challenging and satisfying duties.

When the mechanic locates the cause of the trouble, he adjusts, repairs, or replaces defective parts. For example, he may replace a fuel pump, grind valves, adjust the ignition timing, clean the carburetor, or machine the brake drums.

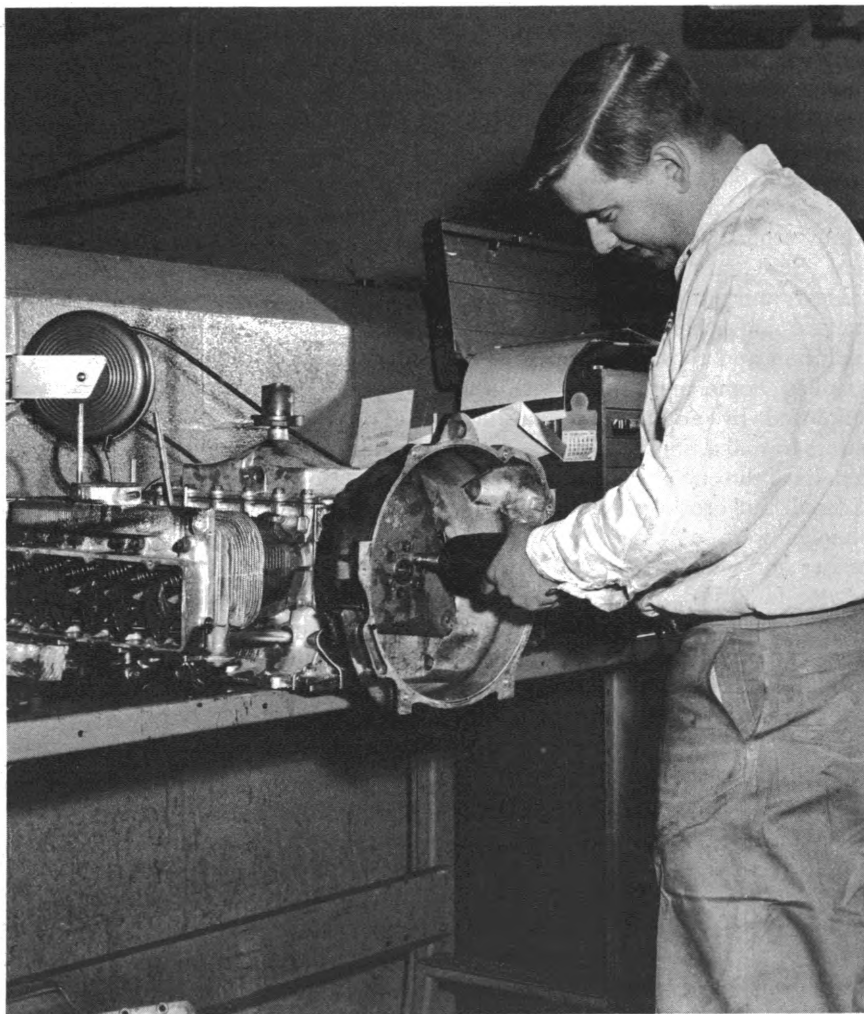
In addition to the testing equipment mentioned previously, automobile mechanics use many other kinds of tools and equipment. These may range from simple handtools (screwdrivers, wrenches, pliers), to complicated and expensive machines and equipment that help the mechanic make repairs. Examples of such equipment are wheel alinement machines and headlight aimers. Mechanics also make use of repair manuals and parts catalogs.

The majority of automobile mechanics perform a variety of repairs. Other mechanics, such as automatic transmission specialists, tune-up men, automobile air-conditioning specialists, front-end mechanics, and brake mechanics specialize in one or two types of repair. However, specialists with all-round skills may also do general automobile repair work. Other specialists, such as automobile radiator mechanics and automobile glass mechanics, who do not have all-round skills, usually work exclusively at their

specialties. The types of work done by some mechanic specialists are described briefly below:

*Automatic transmission specialists* repair and replace linkage, gear trains, couplings, hydraulic pumps, and other parts of automatic transmissions. Automatic transmissions are complex mechanisms; their repair requires considerable experience and training, including a knowledge of hydraulics. *Tune-up men* adjust the ignition timing and valves, and adjust or replace spark plugs, distributor breaker points, and other parts to insure efficient engine performance. They are skilled in using scientific test equipment to locate malfunctions in fuel and ignition systems. *Automobile air-conditioning specialists* in-

stall air-conditioners and repair and adjust compressors, condensers, and other components. *Front-end mechanics* aline and balance wheels and make repairs on steering mechanisms and suspension systems. They are skilled in using special alinement-testing and wheel-balancing machines. *Brake mechanics* adjust brakes, replace brake linings, resurface brake drums, repair hydraulic cylinders, and make other repairs on brake systems. Those employed in repair shops that specialize in brake service may also replace shock absorbers, springs, and mufflers. In some shops, combination front-end and brake mechanics are employed. *Automobile-radiator mechanics* clean radiators with caustic solutions, locate



Automobile mechanic reassembles engine after making major repairs.

and solder radiator leaks, and install new radiator cores. They also may repair heaters and solder leaks in gasoline tanks. *Automobile-glass mechanics* replace broken or pitted windshield and window glass and repair manual and power-window mechanisms. They cut window replacement glass from flat sheets, using window patterns and glass cutting tools. Shops that repair both automobile radiators and glass may employ mechanics who are skilled in both of these specialties.

### Where Employed

Most of the estimated 580,000 automobile mechanics employed in late 1966 worked in independent repair shops (those that do all kinds of automobile repairs or specialize in repairing particular components such as brakes, automatic transmissions, radiators, and glass), in service departments of new and used car dealers, and in gasoline service stations. Many others were employed by Federal, State, and local governments, taxicab and automobile leasing companies, and other organizations that maintain and repair their own automobiles. Some mechanics were also employed by automobile manufacturers to make final adjustments and repairs at the end of the assembly line. A small but growing number of mechanics were employed by department stores that have automobile service facilities.

Most automobile mechanics work in shops employing from one to five mechanics, but some of the largest repair shops employ more than a hundred. Generally, automobile dealers employ more mechanics than independent repair shops.

Automobile mechanics can find employment opportunities in every section of the country, from the largest cities to the smallest towns. About half of them work in the eight States with the largest number of automobiles: California, New York, Pennsylvania, Ohio, Texas, Illinois, Michigan, and New Jersey.

### Training, Other Qualifications, and Advancement

Most automobile mechanics learn the trade through on-the-job experience. Young men usually start as helpers, lubrication men, or gasoline service station attendants, and gradually acquire the necessary knowledge and skills by working with experienced mechanics. Although a beginner can learn to do simple kinds of repair work after a few months' experience, it generally takes at least 3 to 4 years to become an all-round mechanic, and an additional year or two to learn a difficult specialty, such as automatic transmission repair. In contrast, radiator mechanics, glass mechanics, and brake specialists, who do not need an all-round knowledge of automobile repair, may learn their specialties in about 2 years.

Although most automobile mechanics pick up the skills of the trade informally through on-the-job experience, most training authorities recommend the completion of a 3- or 4-year formal apprenticeship program as the best way for young men to learn this trade. Such programs include both on-the-job training and related classroom instruction in nearly all phases of automobile repair.

For entry jobs, employers look for young men who have an understanding of automobile construction and operation, like mechanical work, and have mechanical aptitude. Generally, a driver's license is required. A background in automobile repair gained from working as a gasoline service station attendant, training in the Armed Forces, or experience repairing automobiles as a hobby is valuable. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools are also valuable. Courses in science and mathematics help a young man better understand how an automobile operates.

Training programs for unemployed and underemployed workers seeking entry jobs as automobile mechanics are in operation in a large number of cities under provisions of

the Manpower Development and Training Act. These programs, which in 1966 lasted up to a year, stress basic maintenance and repair work. Men who complete such programs are able to make simple repairs, but they still need additional on-the-job or apprenticeship training before they can qualify as skilled mechanics.

Completion of high school is an advantage in getting an entry mechanic job because most employers believe it indicates that a young man can "finish a job," and has potential for advancement.

Most mechanics are required to have their own handtools. Beginners are expected to accumulate tools as they gain experience. Many experienced mechanics have several hundred dollars invested in their tools. Special tools for servicing units like automatic transmissions and major pieces of test equipment ordinarily are furnished by the employer.

Employers sometimes send experienced mechanics to factory training centers, where they learn about repairing new car models, or receive special training in such subjects as automatic transmission repair and air-conditioning repair. Manufacturers also send representatives to local shops to conduct short training sessions. A relatively small number of young high school graduates are selected by automobile dealers to attend factory-sponsored mechanic training programs for beginners.

Capable and experienced automobile mechanics have several advancement possibilities. A mechanic in a large shop may advance to a supervisory position, such as repair shop foreman or service manager. Many mechanics open their own repair shops or gasoline service stations.

### Employment Outlook

Employment of automobile mechanics is expected to increase moderately through the 1970's. In addition to the several thousand job openings anticipated to occur annually as a result of employment growth, an es-



timated 8,600 job openings are expected to result each year from the need to replace experienced mechanics who retire or die. Job openings will also occur as some mechanics transfer to other lines of work.

Employment of automobile mechanics is expected to increase primarily as a result of the increasing number of automobiles in use. Increases in population, new families, consumer purchasing power, and multicar ownership are expected to contribute to the increase in automobiles. The demand for automobile mechanics also is expected to increase because a growing number of new automobiles will be equipped with features such as air conditioning, power steering, power brakes, and devices that reduce exhaust fumes—all of which increase maintenance requirements.

The favorable employment effects of increasing numbers of automobiles and their greater complexity will be offset partially by greater efficiency in the shop. For example, increased mechanic specialization and growth in the use of test equipment such as dynamometers and engine analyzers should reduce the time needed to diagnose malfunctions and check the quality of repairs. A recent development is "diagnostic centers"—large repair shops that feature production line diagnosis of automobile malfunctions. In these shops, mechanics who are skilled in operating dynamometers and other kinds of test equipment determine needed repairs and route the automobiles to mechanics who are specialists in a particular kind of repair work. Other developments expected to improve efficiency include greater emphasis on replacement rather than on repair of defective parts, better shop management, and improved training methods.

### Earnings and Working Conditions

Skilled automobile mechanics employed by automobile dealers in 34 cities across the country had estimated average straight-time hourly

earnings of \$3.81 in late 1966. All-round mechanics, automatic transmission specialists, and tuneup men generally had the highest earnings. Skilled mechanics generally earned between two and three times as much as inexperienced trainees and helpers.

A large proportion of the automobile mechanics employed by automobile dealers and independent repair shops are paid a percentage—usually about 50 percent—of the labor cost charged to the customer. Under this method, the mechanic's weekly earnings depend on the amount of work he is assigned and how fast he completes it. Many other mechanics receive a weekly salary plus a commission. Some mechanics—for example, those employed by organizations that repair their own fleets of automobiles—receive an hourly rate. Most mechanics work between 40 and 48 hours a week but may work even longer during busy periods. Mechanics paid on an hourly basis frequently receive overtime rates for hours worked in excess of 40 a week.

Many employers of automobile mechanics provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Laundered uniforms are furnished free of charge by some employers.

Generally, the mechanic's work is performed indoors. Modern automobile repair shops are well ventilated, lighted, and heated, but older shops may not have such advantages. Some mechanics make repairs outdoors, wherever breakdowns occur.

The work of the mechanic frequently involves working with dirty and greasy parts, working in awkward positions, and lifting heavy objects. Minor cuts and bruises are common. More serious accidents usually are avoided by observing safety practices.

Some auto mechanics are members of labor unions. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile,

Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

### Where To Go for More Information

For further information regarding work opportunities for automobile mechanics, inquiries should be directed to local employers such as automobile dealers and independent repair shops; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service may also be a source of information about the Manpower Development and Training Act of 1962, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile mechanics may be obtained from:

Automotive Service Industry Association,  
168 North Michigan Ave., Chicago,  
Ill. 60601.

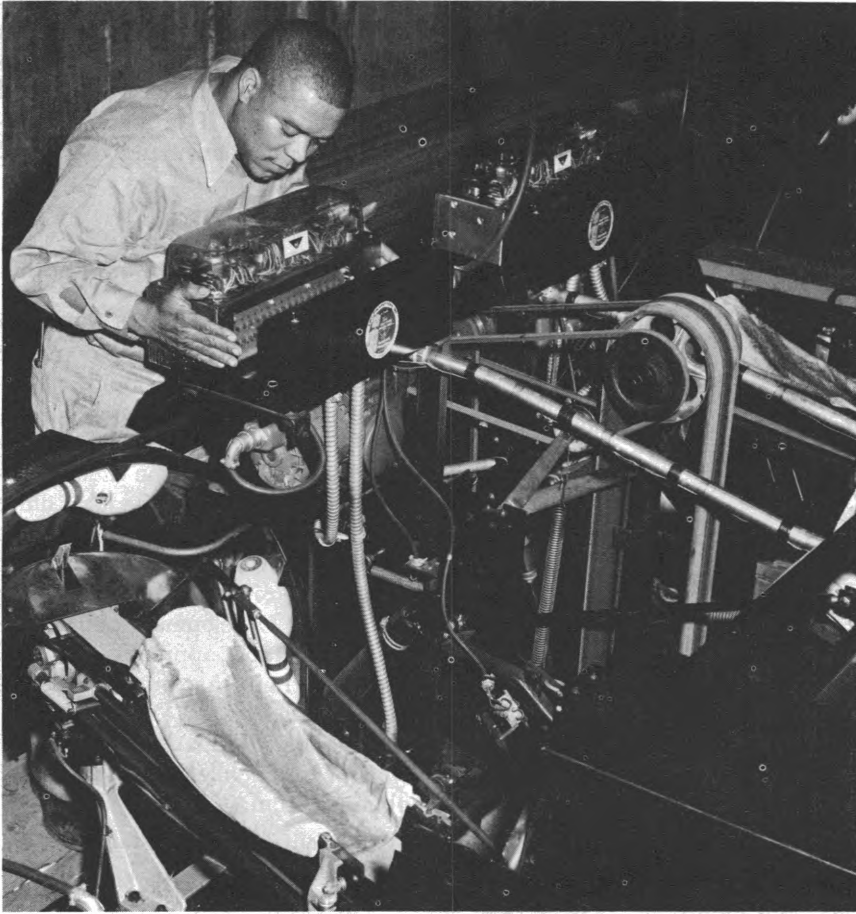
Independent Garage Owners of America, Inc.,  
624 South Michigan Ave., Chicago,  
Ill. 60605.

National Automobile Dealers Association,  
2000 K St. NW., Washington, D.C.  
20006.

### BOWLING-PIN-MACHINE MECHANICS

(D.O.T. 639.381 and 829.281)

Bowling-pin-machine (or automatic pinsetting) mechanics repair, maintain, and adjust the tens of thousands of pinsetting machines in use today. When a breakdown occurs, the mechanic determines its cause and makes the necessary adjustments or



Mechanic searches for source of trouble in control chassis of pin-setting machine.

repairs. He may partially or completely disassemble components of a machine to repair or replace defective parts. After he reassembles the machine, he adjusts it for proper operation.

A pinsetting machine is a complex mechanism that automatically performs a series of operations—returns the bowling ball to the bowler, clears the alley deck of fallen pins, and conveys and distributes the pins to a pinsetting mechanism that resets them on the alley deck. These machines are controlled either mechanically or electrically. Both types of machines are electrically powered and have both mechanical and electrical components. Typically, the duties of the automatic pinsetting machine mechanic include maintaining various gap or clearance adjustments in belts, chains, and other drive devices; mak-

ing clutch and brake adjustments; and inspecting bearings, sliding surfaces, and shock absorbers. If the machine is controlled electrically, the mechanic also maintains the electrical control system.

Much of the mechanic's worktime is spent in preventive maintenance. He regularly inspects and tests pinsetting machines, and he cleans, oils, greases, and adjusts them. In his work, the mechanic applies knowledge gained through training, on-the-job experience, and the use of operating and troubleshooting manuals.

When servicing mechanical equipment, the mechanic uses many different types of tools and equipment, such as pliers, wrenches, screwdrivers, hammers, portable hoists, and lubricating guns. In electrical maintenance and repair work, the mechanic may use soldering irons, feeler gages, and

crimping tools. He uses continuity testers, ammeters, and voltmeters to test electrical circuits, relays, solenoids, transformers and motors. To assist him in this work, he uses diagrams of electrical circuits. Mechanics also use special tools in their work which are supplied by the employer. Often the mechanic will purchase his own set of handtools.

The mechanic may supervise one or more assistant mechanics, trainees, and pinchasers. He is often called upon to instruct trainees in locating and correcting minor malfunctions in pinsetting machines. Such instruction includes demonstrating how the machine operates as well as disassembling components and explaining their function. He shows trainees and pinchasers how to break minor jams and recondition bowling pins. He also explains proper safety procedures.

Some clerical work is done by the mechanic. He maintains a stock of repair parts by keeping inventory records and ordering replacements when necessary. He may also keep records of machine breakdowns and estimate maintenance costs.

### Where Employed

About 7,000 mechanics were employed in early 1967. Most worked in commercial bowling establishments. The remainder, about 10 percent, were employed by manufacturers of automatic pinsetting machines to install and service machines that were rented rather than sold to bowling establishments. Although the primary responsibility of manufacturers' mechanics is to inspect equipment periodically for proper operation, they may be called in to repair major breakdowns that mechanics in bowling establishments cannot handle.

Although mechanics and their assistants are employed in every State, employment is concentrated in the more populated areas, where there are many bowling establishments. Of the more than 11,000 bowling establishments in operation in early 1967, the majority were located in New

York, Pennsylvania, Illinois, Ohio, Michigan, California, Wisconsin, Minnesota, New Jersey, and Texas.

### **Training, Other Qualifications, and Advancement**

Pinsetting machine mechanics usually start out as pinchasers, assisting mechanics in individual bowling establishments. Many pinchasers, who demonstrate mechanical ability and willingness to learn, become trainees and are sent to a mechanics' training school maintained by bowling-machine manufacturers. To become a trainee at a factory school, candidates are required to take written tests to determine their mechanical aptitude and personality traits. Usually, trainees must be at least 16 years old. Trainees' wages and expenses during the training period—usually 4 weeks—are paid by employers. During the training programs, trainees study the structure and operation of the particular type of machine manufactured by the firm operating the school and learn to locate typical sources of trouble. They learn preventive maintenance procedures, how to read wiring diagrams, and how to use the tools of the trade. Their training also includes actual repair work on demonstration machines. After attending factory schools, trainees usually need several months of on-the-job experience before they acquire the skills of the trade.

Trainees who do not attend factory schools acquire their skills on the job by observing experienced mechanics at work and by receiving instruction in machine operation and maintenance, typical malfunctions, and safety procedures. They also do actual repair work, progressing from simple to more complex jobs as their skills increase. Usually, 1 to 2 years of such training and experience is necessary for trainees to acquire mechanics' skills.

Employers prefer to hire pinchasers who are high school graduates, although many workers in this trade have not completed high school.

Courses in electricity, blueprint reading, an machine repair are useful.

Qualified mechanic trainees employed in commercial bowling establishments may be promoted to assistant mechanic and then to head mechanic. Mechanics can become managers or proprietors of bowling establishments. Those who work for manufacturers may advance to the position of service manager, or instructor in a training school.

### **Employment Outlook**

Employment of bowling-pin-machine mechanics is not expected to rise during the remainder of this decade nor in the 1970's. The few hundred job openings that will result each year are likely to stem mainly from the need to replace workers who retire, die, or leave their jobs for other reasons.

Trends in the growth of bowling facilities as well as developments in pinsetting machine technology will be a major influence in the employment of bowling-pin-machine mechanics in the future. Although the demand for bowling facilities is likely to grow with the expanding population, rising income levels, and more leisure time for recreation, there is not likely to be an increase in the employment of mechanics. Improvements in the manufacture of pinsetting machines are being reflected in fewer repairs. In addition, an increasing proportion of the preventive maintenance that these machines require is expected to be performed by less skilled workers. These developments will tend to reduce the overall need for bowling-pin-machine mechanics, and also possibly permit a mechanic to service more than one bowling establishment.

### **Earnings and Working Conditions**

National wage data are not available for pinsetter mechanics and their assistants. However, wage data are available from union-management contracts, in effect in mid-1966, cov-

ering a large number of these workers employed in commercial bowling establishments in large metropolitan areas on the East and West Coasts and in the Midwest. Although these contracts show a very wide range of straight-time hourly pay rates for mechanics and their assistants, the majority provide for hourly rates ranging from about \$2.40 to \$3.40 for mechanics and \$2.00 to \$2.80 for assistant mechanics. It should be noted that many mechanics and their assistants are not covered by union-management contracts.

On the East Coast and in the Midwest, most mechanics and their assistants work a 48-hour, 6-day week. On the West Coast, most of them work a 40-hour, 5-day week. Nightwork and work on Sundays and holidays is common. Workers covered by union-management contracts receive premium pay for overtime work. Also, union-management agreements usually provide for 2 weeks' paid vacation after a year's service and for 3 weeks after 5 years' service, and from 4 to 8 paid holidays a year. Many contracts provide health insurance and pension plans financed entirely by employers.

Mechanics and their assistants work in a long, relatively narrow corridor at one end of a bowling establishment where the automatic machines are located. The work area includes space for a workbench. The workspace is usually well lighted and well ventilated, but quite noisy when the lanes are in operation. When making repairs and adjustments, repairmen frequently have to climb and balance their bodies on the framework of the pinsetting machines, and to stoop, kneel, crouch, and crawl around the machines. Mechanics employed by manufacturers to install and service pinsetting machines are required to do considerable traveling.

Repairmen are not usually required to wear any special safety devices, such as goggles. Safety guards are provided on the pinsetting machines, but workers are subject to common shop hazards, such as electrical shock, cuts, falls, and bruises. Repairmen often wear coveralls to

protect themselves from grease and dirt.

Mechanics, assistant mechanics, and trainees employed in large metropolitan areas generally are members of unions; usually the Building Service Employees' International Union or the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.).

### Where To Go for More Information

A young man who wishes to obtain further information about training or work opportunities in this trade should direct his inquiry to proprietors of commercial bowling establishments in his area, the local bowling proprietors' association, or locals of the unions previously mentioned. The local office of the State employment service is another source of information about employment and training opportunities.

## BUSINESS MACHINE SERVICEMEN

(D.O.T. 633.281 and 828.281)

### Nature of Work and Where Employed

Business machine servicemen maintain and repair the increasing numbers and types of office equipment used for correspondence, for recording and processing transactions, and for duplicating and mailing information. Equipment used for these purposes includes typewriters; adding and calculating machines; cash registers; electronic computers and other data-processing devices; dictating and transcribing machines; and mailing, duplicating, and microfilm equipment. These machines are becoming increasingly complex as electric and electronic control components are incorporated in them.

Servicemen do much of their work in the offices where the machines are

used. Servicemen may maintain this equipment on a regular basis, returning at frequent intervals to inspect the machines, to clean and oil them, and to make minor adjustments or repairs. They may also be called to an office to check or repair a defective machine. On office calls, servicemen usually question the operator about the condition of the machine. They may have to explain to operators how various features of the machines can best be used or how to avoid machine damage.

While inspecting business machines, the serviceman usually checks the operation of various parts of the equipment to make sure that they work properly or to find the source of reported trouble. For example, he may strike the keys of a typewriter or calculator, rotate the drum of a duplicating machine, or feed punch-cards to a tabulator or sorter. In addition, he may check type or photographic devices for alinements and rollers for dryness or compactness. If necessary, covers of machines may be removed to check levers, gears, belts, or spacing mechanisms. He may make voltage checks of electric or electronic components.

When overhaul or major repair is necessary, small units of equipment are generally brought to the shop of the servicing company. Here, servicemen disassemble the machine; inspect components; remove and replace worn bearings, cams, and other parts; and install new belts and feed rolls where necessary. If the machine has electric motors or controls, these also may require adjustment or replacement of parts.

In addition to common handtools, such as screwdrivers, pliers, and adjustable wrenches, business machine servicemen frequently use gages and meters and other test equipment and tools designed for special purposes.

Business machine servicing offers considerable variety in work assignments. Such work requires the application of analytical ability to a wide range of problems. Many persons find considerable satisfaction in being able

to diagnose and correct the cause of trouble in a faulty machine. Some manufacturers' servicemen have the opportunity to evaluate and report on recommended improvements in new and existing company products.

Besides responsibilities for maintenance and repair, servicemen may engage in sales activities. Most commonly, they sell preventive maintenance contracts for machine servicing on a regular basis. Some servicemen also are expected to sell supplies, such as special paper, ink, ribbons and stencils used with particular machines. Generally, commissions or bonuses based on sales are paid, in addition to wages.

Business machine servicemen are employed in several types of firms. Manufacturers of business machines employ more than half of these workers in their sales and service offices throughout the country. Another large proportion of the more than 80,000 business machine servicemen employed in early 1967 worked in local independent establishments; some of these shops specialize in repair work, whereas others combine sales and service. The remainder were employed in large organizations which had enough machines in daily use to justify employing full-time servicemen.

Business machine servicemen employed in a manufacturer's branch office usually work on the manufacturer's products exclusively. In the large branch offices of some companies, they may specialize in servicing one or two of the various types of machines sold. In other companies, even in the larger branches, the fully trained servicemen work on the full line of company equipment. In manufacturers' branches in the smaller cities, where fewer servicemen are needed, most are "full line" servicemen, since the size of the operation makes it impractical to have the men specialize on one type of machine. In these instances, service may also be combined with selling new equipment.

Servicemen employed by independent dealers maintain and repair

the many makes and models of office machines used in the community. Most dealers sell and service typewriters. Some also sell and service adding machines, dictating machines, and less complex types of duplicating equipment. Other dealers specialize in the sales and service of adding and calculating machines, cash registers, and bookkeeping-accounting machines. Most independent dealers employ fewer than 5 servicemen, although some large dealers may employ as many as 10 or 15.

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, where the majority of business machines are located.



Typewriter serviceman uses air jet to remove dust and erasure particles.

*Typewriter Servicemen* (D.O.T. 633.281). The principal work of the estimated 28,000 typewriter servicemen employed in early 1967 was the maintenance and repair of manual and electric typewriters. Typewriters are the most widely used business machines. They are used in almost every business office, as well as by many individuals in their homes. Though the operation of electric typewriters and mechanical typewriters differs, the two types are similar enough that, with additional training, the servicemen who specialize in the repair of mechanical typewriters usually can learn to repair the electric machines.

Typewriter servicemen are employed both in the sales and service branches of typewriter manufacturers and by local independent dealers. Many servicemen operate their own maintenance and repair shops. Typewriter servicemen are found in almost every sizable community throughout the Nation.

*Adding Machine Servicemen* (D.O.T. 633.281). About 6,500 business machine servicemen were engaged mainly in the servicing of adding ma-

chines in early 1967. These machines are less complex than most other office calculating devices. In some cases, servicing of both adding machines and calculators is done by the same employee. The repair of adding machines and simpler calculating machines often provides experience for advancement to work on more complicated equipment, such as bookkeeping and accounting machines. In some independent establishments, adding machines are serviced by men who also repair typewriters.

Adding machine servicemen are employed both in manufacturers' sales and service branches and by independent dealers. Other sources of employment are 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. 633.281). About 5,500 calculating machine servicemen were employed in early 1967. Calculating machines, which have complex mechanisms, add, subtract, divide, multiply, and perform combinations of these operations. In some shops, servicing of calculators is combined

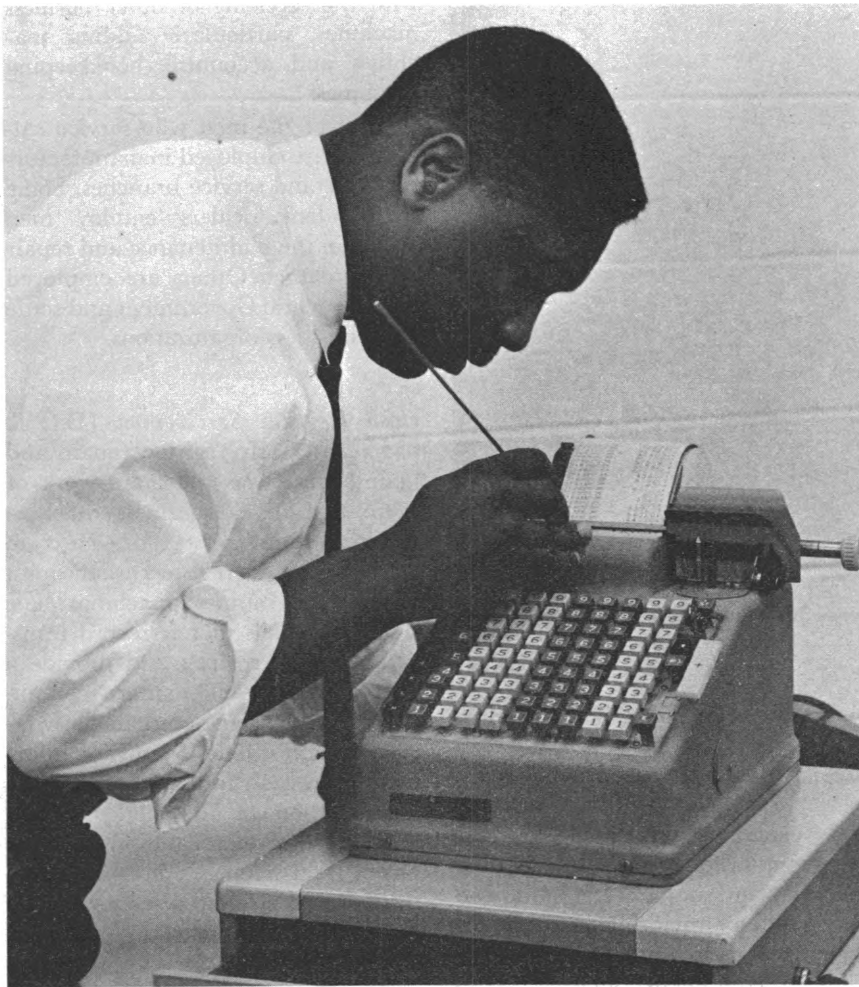
with the servicing of other business machines, particularly adding machines and accounting-bookkeeping machines.

Most of the men who service calculators are employed in manufacturers' sales and service branches. Some independent dealers employ men skilled in the maintenance and repair of calculators. Others are employed by the Federal Government and some large business organizations.

*Cash Register Servicemen* (D.O.T. 633.281). Cash register repair and maintenance was the main work of more than 6,500 business machine servicemen in early 1967. Next to typewriters, cash registers are the most widely used business machines. The simplest models merely record transactions, add receipts, and provide a change drawer. The more complicated cash registers simultaneously record several different kinds of information on each transaction (such as identification of the clerk, department, type of merchandise, payment given, and change due), provide printed receipts, and dispense change and trading stamps to the customer.

The great majority of servicemen engaged primarily in repairing cash registers are employed in the sales and service branches of the few manufacturing firms making these machines. Some of the repair work, especially in smaller communities, is done by independent dealers who also maintain and repair other business machines.

*Accounting-Bookkeeping Machine Servicemen* (D.O.T. 633.281). The repair of accounting-bookkeeping machines was the main work of more than 4,000 business machine servicemen employed in early 1967. These machines perform a variety of operations. Some post entries and some do billing, but others combine the functions of typewriters and computing devices. All models have keyboards, like those on typewriters and adding machines. These machines are used in



Serviceman adjusts cash register.

firms that 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 to fit the accounting procedures used in an individual customer's office. Servicemen set up the controls or programs for such machines from plans which have been devised by the customers and manufacturers' salesmen.

Most accounting-bookkeeping machine servicemen are employed in the sales and service branches of companies manufacturing this equipment. Very few work in independent repair shops.

*Data-Processing Equipment Servicemen* (D.O.T. 828.281). More than

19,000 men were employed in early 1967 to install, modify, and maintain groups of machines (systems) used to process large volumes of accounting-statistical data. These men are the most skilled business machine servicemen. The machines that they service include mechanical and electromechanical devices of varying complexity and highly complicated electronic computers. However, even those machine systems which include the most advanced computers depend to a high degree on associated equipment having electromechanical operating and control mechanisms. This auxiliary equipment feeds information to the computer for data processing and converts the processed data to printed form for immediate use and to magnetic tape and punchcards

for record keeping and further processing. Machines used in data-processing systems include computers, tabulators, card punchers, sorters, collators, converters, tape transports, printers, and numerous other devices.

Servicemen who work on these machines must have a good basic knowledge of electricity, in addition to mechanical skill. 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 Forces. In other companies, experienced men who can repair other types of business machines are given training in electronics by their employers.

Data-processing machine servicemen are employed principally by firms which manufacture and service such equipment. They may be assigned by their companies to work anywhere in the United States, but they are usually stationed in the larger cities. Some are assigned to a large system in one location; others have territories containing a number of machines or systems.

*Dictating Machine Servicemen* (D.O.T. 633.281). More than 2,000 men were employed to repair and service dictating machines in early 1967. These machines are used in business offices to record dictation on disks, belts, wire, or tape which can be played back for typing. In addition to standard office dictating machines, servicemen install and maintain central recording and transcribing systems.

Dictating machine servicemen must have a knowledge of electronic fundamentals in order to maintain and repair sound-amplifying components of this equipment. Mechanical skills are essential in maintenance work on drive mechanisms needed to control the movement of the recording disk or belt.

Dictating machine servicemen are employed throughout the country with concentrations in the large business and commercial centers. Most servicemen work in the sales and serv-

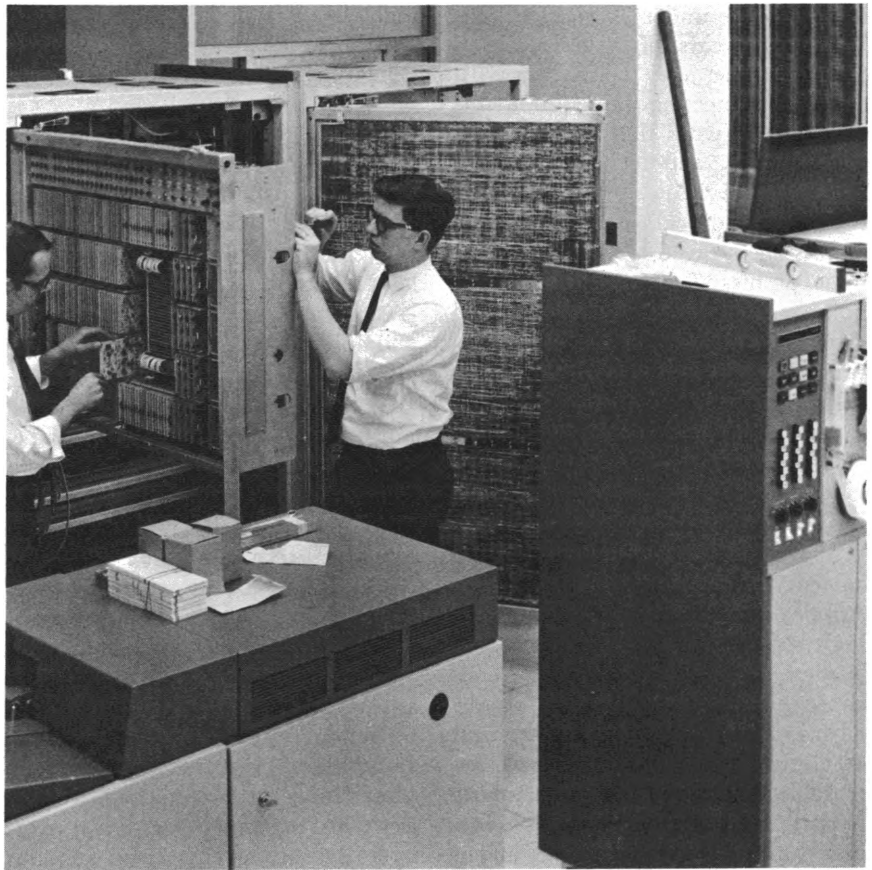
ice branches of business equipment manufacturers or for their distributors. Typewriter and adding machine servicemen employed by some independent dealers also service dictating machines.

*Duplicating and Copying Machine Servicemen* (D.O.T. 633.281). Nearly 6,000 men were employed in early 1967 to maintain and repair duplicating and copying machines. These machines are used to make one or more paper copies of printed or written information. The processes used in these machines range widely, from highly complex methods for large volume reproduction to relatively simple methods used in desk-top copiers. The equipment used in a single process may also vary considerably, from relatively simple hand-operated devices used to make up to five paper copies to highly complicated electro-mechanical machines having automatic controls which can duplicate several hundred copies quickly.

When maintaining duplicating or copying machines, the serviceman adjusts, oils, repairs, or replaces parts such as rollers, belts, or gear mechanisms. If the equipment has electric or electronic components, he may check voltages to determine the need for adjustment or replacements of parts. He may also clean the machine so that it will function properly and produce clear copy.

Duplicating and copying machine servicemen employed by some companies also service microfilm equipment used in office operations. The maintenance and repair of paper-handling mechanisms used to speed the movement of documents, including drawings, through the photographic equipment is generally similar to that used in duplicating machines. The men who service this equipment, however, must understand the photographic process used in order to properly align the optical devices so as to produce clear, sharp negatives.

Most duplicating and copying machine servicemen are employed in the



Service technicians install large-scale computer system.

branch sales and service offices of manufacturers or by their distributors.

*Servicemen of Postage and Mailing Equipment* (D.O.T. 633.281). More than 3,000 servicemen were employed in early 1967 to maintain and repair the many different types of office machines and equipment needed to handle the billions of pieces of mail sent each year by business firms in this country. These office machines included postage meters, addressing and imprinting machines, and folding and inserting equipment. Data-processing machines used for tabulating and imprinting account information are also used in addressing operations where the volume of accounts justifies.

Servicemen who work on these predominantly electromechanical machines install the equipment, and adjust, oil, clean, and repair or replace

components to keep the equipment in working order. As with most paper handling equipment, rollers and other manipulating devices driven by belt or gear mechanisms are the components most frequently requiring maintenance. Since most postage and mailing equipment is electrically powered, and an increasing number of machines use electric or electronic controls, the servicemen must have a basic knowledge of electricity. In addition, a knowledge of electronic theory is a decided advantage.

Most men who service postage and mailing equipment are employed in the branch offices of equipment manufacturers.

#### Training, Other Qualifications, and Advancement

Employers prefer applicants for entrance jobs as business machine serv-

icemen to be under 30 years of age. The early years of a serviceman's career can be very active ones. In addition to meeting the requirements of a type of work that requires tact, good humor, and technical competence in servicing office machines throughout a local area, the serviceman is encouraged to devote at least some of his evenings each week to home-study or academic training in order to broaden his technical knowledge of business equipment and increase his general education. Men up to the age of 40, however, may be considered by some employers provided they have had applicable training or experience.

Trainees usually are required to have at least a high school education. Applicants who have not completed high school, however, are accepted by some companies if they can demonstrate superior mechanical aptitude, or have had qualifying mechanical or electrical experience. Completion of high school becomes particularly important, however, when a serviceman has acquired basic skills and is seeking to work on more complex equipment or to be promoted to supervisor. Applicants interested in servicing complex electromechanical and electronic equipment may be required to have 1 or more years' training or experience in mechanics or electronics, in addition to a high school education, to qualify.

Most employers require business machine servicemen to be bonded. Applicants for such jobs must have a record of honesty and trustworthiness because, in their work, servicemen are brought in proximity to large sums of money and other valuables in banks, offices, and other establishments. Servicemen may also collect money for services performed and office supplies delivered to their customers.

Applicants for entrance jobs frequently must pass one or more tests. Mechanical aptitude is the characteristic most frequently tested although a knowledge of basic electricity or electronic fundamentals is increas-

ingly being tested. Applicants may also be tested for manual dexterity, general intelligence, and abstract reasoning.

Employers look for applicants who have a pleasant, cooperative manner. Most machine servicing is done in customers' offices, and a serviceman's ability to do his work with the least interference with office routine is very important. A neat appearance and ability to converse effectively are also desired characteristics.

Young men entering the business machine servicing field generally begin as trainees and acquire their skills through on-the-job training, work experience, and instruction in manufacturers' training schools. Courses in business machine maintenance and repair, conducted by some State and city vocational schools and by private correspondence schools, are available to trainees and others interested in this field of work. In addition, programs to train unemployed and underemployed workers as office machine servicemen were operating in several cities in 1967 under provisions of the Manpower Development and Training Act.

Business machine servicemen who are hired for work in a manufacturer's branch office are trained to service only the company's line of machines. Independent shops, which look for men who can service many makes of machines, will either hire men with previous experience on one or more types of machines or will give a new man informal training on several different makes. Training programs lasting from 2 to 4 years are conducted by some manufacturers and independent dealers.

Men hired as trainees in manufacturers' branch offices usually are sent to company schools for periods lasting from several weeks to several months, depending on the type of machine they will service. They then receive from 1 to 3 years of practical experience and on-the-job training before they are considered fully qualified. During this period, they may occasionally go back to factory schools

for additional training. Even after becoming skilled workers, they may return to school for special instruction in new business machine developments. In addition to training in company schools, servicemen at manufacturers' branch offices are encouraged to broaden their technical and general knowledge during their nonworking hours. Many companies provide full or partial tuition grants for a variety of courses at academic institutions, as well as for home-study courses in subjects related to the serviceman's work.

Men in independent establishments generally learn the trade by working with experienced servicemen who instruct them in the skills of the trade. Occasionally, men employed by an independent dealer who is authorized to sell and service a manufacturer's products will be sent to the manufacturer's school for training. Generally, however, men in independent shops receive little formal training.

Length of training depends on the kind of establishment in which a man is employed. In independent shops, the time required to become a skilled serviceman tends to be somewhat longer than in manufacturers' branches because of the greater variety of machines and the generally informal nature of the training.

The training period also varies in relation to the complexity of the equipment, and the serviceman's ability to become thoroughly skilled in the maintenance, repair, and other activities associated with less complicated business machines, such as typewriters, adding machines, and some photocopy equipment. For the servicing of calculating machines, about 2 years of training and experience are required. Cash register repairmen learn their work in from 2½ to 3½ years, the last 6 months of which are usually spent in the company school. Skilled accounting-book-keeping machine repairmen generally must have at least 3 to 4 years of training and experience. The first 1 to 2 years may consist of servicing



adding machines, calculators, or cash registers, since this is considered valuable background for servicing accounting-bookkeeping machines.

Most machines used in data-processing systems contain electrical equipment; many have electronic components. The companies which manufacture and service these machines, therefore, usually require that applicants have some knowledge of electricity or electronics. In qualifying for employment 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 specially desired by employers in this field. Because of the complexity of some computer systems, these servicemen usually must have considerable analytical ability as well as a broad technical background. For example, they may have to be familiar with computer programing in order to identify programing procedures as a possible cause of a malfunction. 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 6 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.

Servicemen frequently have the opportunity to move into sales positions where their earnings may be greater. In some cases, service and sales work are combined. Men who show exceptional abilities also have opportunities for promotion to foreman, service manager, or other supervisory positions, and to serviceman training or product engineering divisions of their companies. 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

The rapidly growing business machine service field will provide several thousand job opportunities for young men each year during the remainder of the 1960's and throughout the 1970's. Many of these job opportunities will occur because of the need to replace experienced workmen who retire, die, or transfer to other fields of work.

The more than 80,000 servicemen employed in early 1967 were more than double the number working during the mid-1950's. The greater employment of servicemen has been due to the increasing use of many types of office machines to do all kinds of clerical work in our expanding commercial and industrial establishments. In recent years, there have been many technical changes in long established types of business machines. For example, electrically driven mechanical equipment, such as typewriters and adding machines, is rapidly taking the place of nonelectrical mechanical machines which do the same work. The increasing use of this more complex equipment, which requires additional maintenance, has also increased the need for business machine servicemen, especially those who have good mechanical ability and a knowledge of electricity or electronics.

Opportunities for employment in the servicing of electronic business machines systems will be particularly favorable in the years ahead. The use of such machines has expanded greatly in recent years, and demand for this equipment is expected to be even greater in the future. Additional job opportunities may arise as a result of new complex equipment, now being introduced, which permits automatic retrieval and printout of masses of stored information. Such equipment has great potential for widespread application in business, scientific, institutional, and other fields.

Business machine servicemen have year-round employment—steadier than many other skilled trades. The office machines serviced by these men must be maintained, even when business slackens, since business records must be kept, correspondence carried on, and statistical reports prepared. Men who establish themselves in the business machine service field can expect continuing employment for many years.

### Earnings and Working Conditions

Information obtained from a number of employers of business machine servicemen in early 1967 indicated that earnings of experienced servicemen generally ranged from \$95 to \$150 a week, depending on the type of machine they serviced, where they were employed, and their length of service with employers. Wages were lowest for men who repair only typewriters, adding machines, or less-complex types of photocopy equipment; the earnings of these workers usually ranged from \$95 to \$130 a week. Cash registers, calculators, accounting-bookkeeping machines, and nonelectronic accounting-statistical machines require more skill to repair. Consequently, the men who work on them receive somewhat higher pay rates, generally from \$115 to \$150 a week. Highest rates are paid to men who service electronic data-processing machines. The most highly skilled electronic computer servicemen were earning as much as \$235 a week.

Servicemen trainees begin at wages considerably below these levels; they receive pay increases as they become increasingly skilled during the training period. Starting wages generally ranged from \$80 to \$100 a week. Men with previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages. In addition, many business equipment manufacturers have a merit rating plan that provides for periodic review of employee salaries. The merit

salary increases resulting from such review usually are based on the serviceman's ability, training, and customer relationship.

In addition to their salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Many servicemen employed by manufacturers and independent dealers are covered by group life and hospitalization insurance plans and pension plans.

Servicing of business machines is cleaner and lighter work than the work in most other mechanical trades. Servicemen generally wear business suits and perform most of their work in the offices where the machines are used. The occupation is comparatively free from the danger of accident. Some of these positions involve considerable traveling within the area served by the employer. For this reason, many employers require that servicemen own or have the use of a car. The serviceman generally is reimbursed for company use of his car on a mileage basis. Other servicemen may work in a very concentrated area, depending on the city size and the number of machines. Work tools usually are supplied by the employer.

### Where To Go for More Information

Additional information about employment in the field of business machines servicing may be obtained from local dealers who sell and service typewriters, adding, and dictating machines as well as from branch sales and service offices of equipment manufacturers. Technical and vocational schools that offer courses in electricity, electronics, or office machine maintenance and repair can provide helpful information about the kind of training needed to qualify as a business machine serviceman. In addition, the local office of the State employment service will provide information about training programs under the Manpower Development and Training Act.

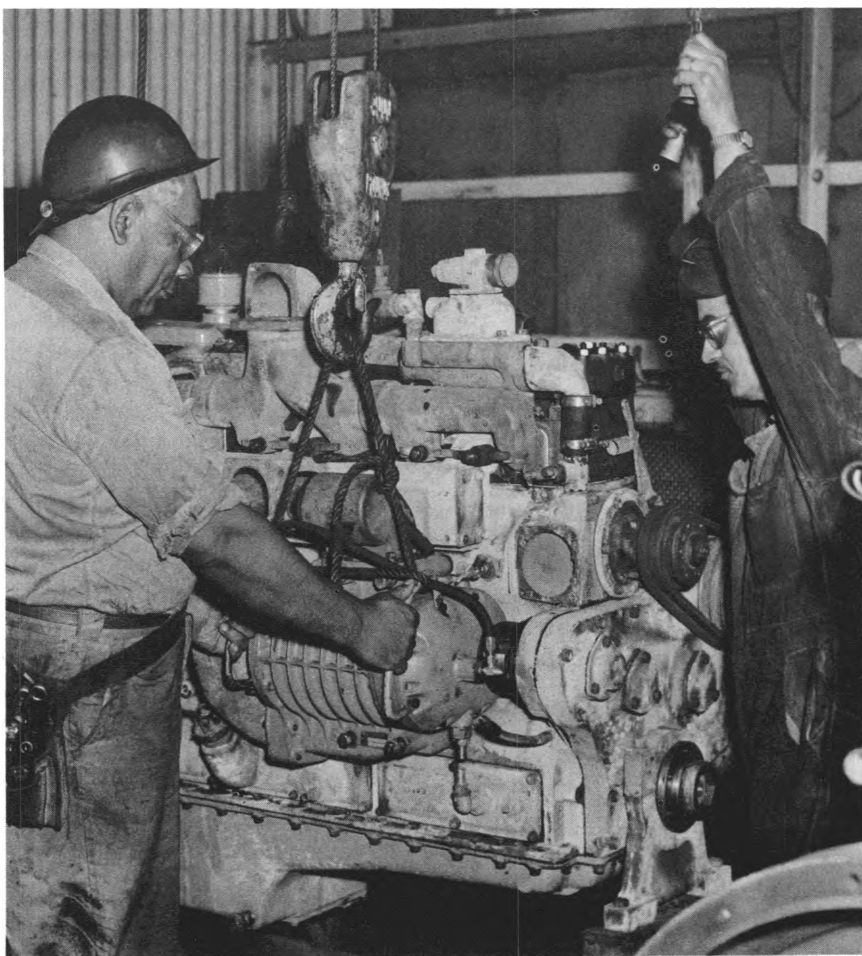
## DIESEL MECHANICS

(D.O.T. 625.281)

### Nature of Work

Diesel mechanics repair and maintain diesel engines that power transportation equipment such as heavy trucks and buses, ships and boats, locomotives and other railroad equipment; construction equipment, such as bulldozers, earthmovers, and cranes; and farm equipment such as tractors and irrigation pumps. In addition, they are responsible for the maintenance and repair of a variety of other diesel-powered equipment including generators, compressors, and pumps used in public utilities; and oil-well drilling rigs.

Before making repairs, a diesel mechanic inspects and tests engine components to determine why an engine is not operating properly. After the cause of the trouble has been located, he repairs or replaces defective parts and makes necessary adjustments. Preventive maintenance—avoiding trouble before it starts—is another major responsibility of the mechanic. For example, he may periodically inspect, test, and adjust engine components. Many diesel mechanics make all types of diesel engine repairs; others specialize, for example, in rebuilding engines or in repairing fuel injection systems, turbochargers, cylinder heads, or starting systems. Some diesel mechanics also repair large natural gas engines which are used to power generators, pumps, and other industrial equipment.



Mechanics install supercharger on diesel engine.

Diesel mechanics often have job titles that indicate the type of diesel-powered equipment they repair. For example, those who repair the diesel engines in trucks may be called truck mechanics (diesel). Those who work on construction equipment, such as bulldozers and earthmovers, are usually called heavy equipment mechanics (diesel). Railroads classify the workers who repair locomotive diesel engines as machinists, electricians, or sheet-metal workers, depending on the type of diesel repair work they perform. In addition to engine maintenance and repair, the mechanics listed above (except those employed by railroads) may work on other parts of diesel-powered equipment. For example, truck mechanics (diesel) may work on brake and steering systems, transmissions, and other truck parts. (See statement on Truck Mechanics and Bus Mechanics.)

Diesel mechanics use common handtools, such as pliers, wrenches, and screwdrivers, as well as special tools, including valve refacers and piston pin-fitting machines. In addition, they may use complex testing equipment, such as a dynamometer, which measures engine power, and special fuel injection testing equipment. Mechanics may also use machine tools, including grinders, drills, and lathes to make replacement parts for diesel-powered equipment. They use powered hoists and other materials handling equipment for lifting and moving heavy parts.

### Where Employed

Many diesel mechanics are employed in the service departments of distributors and dealers that sell diesel engines, farm and construction equipment, and trucks. Diesel mechanics are also employed by companies and government agencies that repair and maintain their own diesel-powered equipment. This group includes local and intercity buslines, construction companies, trucking companies, rail-

roads, and State highway departments. Other employers of diesel mechanics include manufacturers of diesel engines and independent repair shops that specialize in the repair of diesel engines.

Diesel mechanics are employed in all parts of the country. Large numbers of these workers, however, are employed in California, New York, Illinois, and Texas—States where high levels of construction, commercial, industrial, and farming activity have resulted in the use of great numbers of diesel-powered machines.

### Training, Other Qualifications, and Advancement

Diesel mechanics learn their skills in several different ways. Most young men who become diesel mechanics first work as mechanics repairing gasoline-powered automobiles, trucks, and buses. They usually start as helpers to experienced gasoline engine mechanics and become skilled in this work by working with them for 3 to 4 years. When employed by firms that use or repair diesel powered equipment, they are given 6 to 18 months' training in the maintenance and repair of such equipment. While learning to fix diesel engines many of these men find it helpful to take courses in the repair and maintenance of diesel equipment, offered by vocational, trade, and correspondence schools.

Some diesel mechanics, such as those employed by diesel engine manufacturers, learn their trade through formal apprenticeship programs. These programs, which generally last 4 years, give trainees a combination of classroom training and practical experience in repairing diesel engines. Apprentices receive classroom instruction in blueprint reading, hydraulics, welding, and other subjects related to their work. In their practical training, they learn about valves, bearings, injection systems, starting systems, cooling systems, and other parts of diesel engines.

Some young men prepare for diesel mechanic jobs by full-time attendance at trade or technical schools that offer comprehensive training in diesel engine maintenance and repair. Such training programs last from several months to 2 years, and provide practical experience and related classroom instruction. Graduates of such programs, however, usually need additional on-the-job training before they can become skilled mechanics.

Training programs for diesel mechanics, and for others in occupations that involve diesel engine repair work, were in operation in several cities in 1966-67 under the provisions of the Manpower Development and Training Act. Unemployed and underemployed workers who meet certain minimum requirements are eligible to apply for such training, which usually lasts at least 36 weeks.

Other young men learn the trade through less formal training programs. Generally, they are hired as trainees by employers who use or repair large quantities of diesel powered equipment. Trainees are taught by experienced mechanics to do all kinds of diesel repair jobs.

Experienced diesel mechanics employed by companies that sell diesel-powered equipment are sometimes sent to special training classes conducted by diesel engine manufacturers. In these classes, mechanics learn to maintain and repair the latest diesel engines, using the most modern equipment.

Employers prefer to hire trainees and apprenticeship applicants who have a high school education as well as mechanical ability. Shop courses in automobile repair and machine-shop work, which are offered by many high schools and vocational schools, are helpful. High school courses in science and mathematics are valuable because they give a young man a better understanding of diesel engine operation. Young persons interested in becoming diesel mechanics should be in good physical condition because

the work often requires lifting heavy parts.

Many diesel mechanics are required to have their own handtools. Experienced mechanics usually have several hundred dollars invested in their tools. A beginner is expected to accumulate tools as he gains experience.

Diesel mechanics who work for organizations that operate or repair large fleets of diesels, such as buslines or diesel equipment distributors, may advance to leadman and to supervisory positions—shop foreman or service manager.

### Employment Outlook

Employment of diesel mechanics is expected to increase very rapidly during the next decade. In addition to employment growth, many job openings will result from the need to replace experienced mechanics who are promoted, retire, transfer to other fields of work, or die.

The rise in employment of diesel mechanics is expected mainly because most industries that use diesel engines in large numbers are expected to expand their activities in the years ahead. In addition, diesel engines will continue to replace gasoline engines in a growing variety of equipment. For example, small delivery trucks powered by diesel engines are in limited use today, but are expected to be used on a larger scale in the future. Also, diesel-powered farm equipment will become more common.

Most new job openings in this field will be filled by mechanics who have experience in repairing gasoline engines. Companies that replace gasoline engine equipment with diesel-powered equipment usually retrain their experienced mechanics to service the diesel equipment. Companies that buy additional diesel engines to meet expansion needs usually hire experienced diesel mechanics. Men who have school training in diesel repair, but no practical experience, may be able to find jobs only as trainees.

### Earnings and Working Conditions

National wage data are not available for diesel mechanics. However, wage data collected from employers of workers who repair trucks, buses, construction equipment, and stationary engines, indicate that many diesel mechanics earned from about \$2.50 to \$4.00 an hour in late 1966.

The weekly work schedule of diesel mechanics ranges from 40 to 48 hours a week. Many mechanics work at night or on weekends, particularly if they work on buses, diesel engines used in electric light and powerplants, or other diesel equipment used in serving the public. Some of these workers are subject to call for emergencies at any time during the day or night. Diesel mechanics generally receive a higher rate of pay when they work overtime hours, evenings, or weekends.

Many diesel mechanics receive vacations and holidays with pay. In addition, they may receive health and life insurance benefits, which are at least partially paid for by their employers.

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. Diesel mechanics who work for buslines or construction companies sometimes make repairs outdoors where the breakdowns occur. If proper safety precautions are not taken, there is some danger of injury when repairing heavy parts that are supported on jacks or hoists. In most jobs, the mechanics handle greasy tools and engine parts. It is sometimes 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 and Aerospace Workers; the Amalgamated Transit Union; the Sheet Metal Workers' International Association; the International Union, United Automobile, Aerospace and

Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers.

### Where To Go for More Information

Young people who wish to obtain further information about work opportunities in this trade should direct their inquiries to the local office of the State employment service and to firms that use or service diesel-powered equipment, such as truck and buslines, truck dealers, and construction and farm equipment dealers. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. They should also contact the national offices of the unions listed below for information on work and training opportunities in this trade, or for the names and addresses of locals of the unions that can provide such information:

International Association of Machinists and Aerospace Workers,  
1300 Connecticut Ave. NW., Washington, D.C. 20036.

Amalgamated Transit Union,  
5025 Wisconsin Ave. NW., Washington, D.C. 20016.

Sheet Metal Workers' International Association,  
1000 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,  
8000 East Jefferson Ave., Detroit, Mich. 48214.

### ELECTRIC SIGN SERVICEMEN

(D.O.T. 824.281)

The electric signs—neon and illuminated plastic—that advertise the names, products and services of the

hundreds of thousands of factories, stores, restaurants, hotels, and other types of business and commercial establishments across the country are maintained and repaired by electric sign servicemen. These repairmen may also build and assemble signs in electric signmaking and repair shops, and install the signs on location. Although the duties of electric sign servicemen may range from painting and cleaning signs to repairing small cracks in them, their main concern is to maintain the electrical systems in the signs.

Electric sign servicemen diagnose the cause of trouble in improperly operating signs. Minor repairs, such as replacing burned-out lamps, are

performed at sign locations, whereas signs needing an overhaul may be taken to sign shops for repair. Sometimes faulty components, such as a motor, are removed and also taken to the shops for repair. After the signs or components have been repaired, the servicemen return them to their locations and install or replace them. In their work, electric sign servicemen use handtools such as wrenches, pliers, screw drivers, and tin snips. They also use such devices as test lamps and voltmeters.

On service calls for neon signs, the servicemen may find transformers at fault. They will then replace them with new units of the same size and power. If neon tube units are defec-

tive, the servicemen remove them, insert jumper wires so that the signs continue to operate, and take the defective tubes to the shops for repair. The servicemen may repaint portions of neon tubing to increase the readability of the signs and make the letters stand out. In addition, they may tighten or weld parts which have been loosened in high winds or dented during erection. They may also paint the beams, columns, and other exterior framework of the signs before leaving.

On service calls for an illuminated plastic sign, the servicemen may find burned-out ballasts or defective sockets. In replacing ballasts, the servicemen may refer to wiring diagrams and charts that indicate connections, voltage output, and other information needed to install ballasts. Defective sockets usually appear cracked and are replaced with new ones. Small cracks in the plastic face of the sign may also be repaired by the servicemen before they complete their calls.

Electric sign servicemen also perform preventive maintenance. They check signs and remove such things as birds' nests and accumulated water and replace missing handhole covers. Also, gears, drives, pinions, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated. Servicemen sometimes suggest to customers ways to increase the attractiveness and visibility of signs. For example, they may recommend changing the color of neon tubing, attaching flashers, or raising the height of a sign.

Servicemen usually must fill out reports, noting the date, place, and nature of service calls. They may also estimate the cost of service calls, and sell maintenance contracts to sign owners. Chief servicemen prepare work schedules for other electric sign servicemen.

**Where Employed**

Nearly 6,000 electric sign servicemen were employed in early 1967, primarily in small shops that manu-



Electric sign serviceman installs lamps in illuminated plastic sign.

facture, install, and service electric signs. Some servicemen were also employed in independent electric sign repair shops. Both types of shops may service signs that have been mass produced in large sign manufacturing establishments and shipped about the country for installation. A few electric sign servicemen were employed in outdoor advertising establishments and commercial sign shops that manufacture, erect, and maintain electrical signs in addition to performing their regular functions.

Electric sign servicemen are employed in every State. However, more than half are employed in New York, Illinois, California, Ohio, and Pennsylvania, where there are large numbers of industrial and commercial centers.

### **Training, Other Qualifications, and Advancement**

Most electric sign servicemen are hired as trainees and learn their trade informally while working on the job. Trainees rotate through the various phases of signmaking to obtain a general knowledge of sign fabrication—such as cutting and assembling metal and plastic signs; mounting neon tubing; wiring signs; and installing sockets, lamps, time switches, and photoelectric circuits. During each phase, they observe, work with, and receive instructions from experienced craftsmen. The duration of the training varies with the individual's capabilities and his prior education and experience. At least 3 years are required to become a fully qualified serviceman. After completion of training, trainees are usually assigned to a permanent job depending on their preferences and employers' needs.

Some servicemen learn their trade through electricians' apprentice programs, and specialize in signmaking and repairing. Applicants for these programs are generally required to be between the ages of 18 and 25, and have high electrical and mechanical aptitudes. These programs generally

last from 3 to 5 years, and include on-the-job training in signmaking and repairing and classroom instruction in such fields as mathematics, electrical theory and codes, and blueprint reading. A few servicemen acquire their skills through special apprenticeship programs in sign construction, erection, and servicing. Such programs usually include courses in metal and plastic sign fabrication, wiring of signs, installation techniques, and trouble shooting, in addition to courses similar to those taken by electrician apprentices. During the apprenticeship period, the beginners learn to use and handle the tools, equipment, and materials of the trade.

Employers prefer to hire trainees who have a high school education. They look for men who have mechanical ability and an interest in learning the sign business. All electric sign servicemen are familiar with the National Electric Code; some must also be familiar with local electric codes. Many cities require servicemen to be licensed. Licenses can be obtained by passing a comprehensive examination in electrical theory and its application.

Servicemen need good color vision because electric wires are frequently identified by color. Electrical sign servicemen are generally required to own their own handtools, but power tools are usually furnished by employers. Many of these workers invest up to \$100 in handtools.

Highly skilled servicemen may become electric sign foremen and supervise the work of other servicemen. Because of their experience in servicing signs and dealing with customers, electric sign servicemen sometimes become sign salesmen. Also, servicemen with sufficient funds can open their own sign manufacturing or repair shops.

### **Employment Outlook**

Employment of electric sign servicemen is expected to increase rapidly during the 1970's, producing

several hundred new job openings annually. A few hundred job openings will also result each year from the need to replace workers who retire, die, or leave their jobs for other reasons.

The demand for electric sign servicemen will be spurred by a very rapid increase in the number of signs in use. The establishment of many new business and commercial enterprises, competition among businesses in attracting customers, and the modernization of established enterprises will result in an expanding number of new sign installations. In addition, the many electric signs already in use will continue to require servicing over the period.

Although the number of signs in use is expected to grow very rapidly, the employment of electric sign servicemen will not show a corresponding increase. Since the 1950's there has been a trend from neon to illuminated plastic signs which are lighter in weight and easier to maintain. This trend is expected to continue in the future. In addition, new equipment, such as highly versatile boom and ladder trucks, has become available to speed the servicing of signs. The substitution of pressure cleaning equipment for manual cleaning methods is another factor tending to limit somewhat the growth in requirements for sign servicemen.

### **Earnings and Working Conditions**

The earnings of electric sign servicemen compare favorably with those of other skilled workers. According to a survey of wages and fringe benefits in 1966, covering 38 cities in 17 States and the District of Columbia, the average hourly union wage rates of experienced electric sign servicemen ranged from \$2.52 to \$5.62. In more than half of the cities surveyed, straight-time hourly earnings for these craftsmen ranged between \$3.51 and \$3.90 an hour. Apprentice rates usually started at about half the journeymen's hourly wage rate, and increased every 6 months, moving up

to about 90 percent of the journeyman's rate during the final year of the program.

According to the survey, most electric sign servicemen worked an 8-hour day, 5 days a week, and received premium pay for overtime work in 1966. In some cities, they also received premium pay for working at heights in excess of 30 feet. Servicemen received a week of paid vacation after 1 year's service, and 2 weeks or more thereafter, depending on the length of service. They also received from 6 to 8 paid holidays a year. In addition, many employers paid part or all of the cost of life, health, and accident insurance; some also contributed to retirement plans. When uniforms were required, the cost was usually partly or entirely paid for by the employer, who sometimes also provided for their upkeep.

Because most signs are displayed out of doors, electric sign servicemen are constantly exposed to all types of weather conditions. In addition, they are sometimes required to make emergency repairs at night, on weekends, and on holidays. Servicemen often work from scaffolds, catwalks, and ladders; sometimes in awkward or cramped quarters. Some servicemen occasionally work at night patrolling areas in search of improperly operating signs. Common personal hazards in the trade include electrical shock, burns, and falls from high places. Emphasis on safety principles in training programs, however, has helped reduce such accidents. In addition, the use of safety belts, and baskets on boom trucks for easy access to signs has also reduced the frequency of these accidents.

### Where To Go for More Information

For further information regarding work opportunities for electric sign servicemen, inquiries should be directed to local sign manufacturing shops, the local office of the State employment service, or locals of the International Brotherhood of Electrical Workers.

General information about the work of electric sign servicemen may be obtained from:

National Electric Sign Association,  
10912 S. Western Ave., Chicago, Ill.  
60643.

### FARM EQUIPMENT MECHANICS

(D.O.T. 624.281)

The equipment used by farmers to plant, cultivate, and harvest food is serviced by farm equipment mechanics. These craftsmen maintain the electrical, mechanical, and hydraulic systems in all types of farm machinery such as tractors, combines, pickup balers, corn pickers, crop dryers, field harvesters, and elevators and conveyors. In addition, they may assemble new farm implements and machinery that have been shipped in sections to farm equipment dealers. Sometimes, they may be required to repair dented and torn bodies of farm equipment. Much of the mechanic's time, however, is spent repairing and adjusting diesel- and gas-powered tractors. When a tractor is malfunctioning, it may be driven or hauled to a shop for repair. In planting or harvesting seasons, however, the mechanic may travel to the farm where the tractor is located.

Farm equipment mechanics use a variety of testing equipment. For example, they may use a dynamometer, a complex device which measures engine performance. A compression tester may also be used to determine whether piston rings are worn or cylinder valves leak. After determining the cause of the trouble, mechanics make the necessary repairs. They may repair the transmission and tune or overhaul the engine completely. If parts of the engine are worn or broken, they may repair or replace them. They may use welding equipment or power metalworking tools to repair broken parts. They also use



Farm equipment mechanic assembles transmission shaft of tractor.

handtools in their work such as wrenches, pliers, hammers, and micrometers. Often mechanics must make emergency repairs to equipment so that ripening crops can be harvested before they spoil. The skill of mechanics is often determined by their ability to keep equipment operating.

Mechanics also perform preventive maintenance. Periodically, they test parts of farm machinery, clean vital components, and tune engines. In large shops, mechanics may specialize in certain types of repair, such as engine overhaul or clutch and brake repair. To guide their work, farm equipment mechanics use instruction books and maintenance manuals that describe the way farm equipment is assembled and maintained. Some farm equipment mechanics also re-

pair plumbing, electrical, irrigation, and other equipment located on farms.

### Where Employed

Most of the estimated 40,000 farm equipment mechanics employed in early 1967 worked in service departments of farm equipment dealers. These dealers sell and service new and used farm equipment. Other mechanics worked in independent repair shops, in repair shops on large farms, and in service departments of farm equipment manufacturers.

Most farm equipment repair shops employed fewer than five mechanics. These shops were located in the agricultural areas of the country. About half of the mechanics were employed in Iowa, Kansas, Illinois, North and South Dakota, Minnesota, Nebraska, Missouri, Indiana, Wisconsin, Ohio, and Michigan.

### Training, Other Qualifications, and Advancement

Most farm equipment mechanics are hired as helpers and learn the trade working on the job. As helpers, they assist qualified mechanics and assemble new farm equipment and perform rough body repair work. The duration of on-the-job training varies with the helper's aptitude and prior experience. Some helpers can do simple repair jobs after 6 months. Generally, however, at least 3 years of on-the-job training are necessary before a person can become a qualified mechanic.

A few mechanics also learn the trade by completing an apprenticeship training program. Apprentice trainees are usually chosen from among shop helpers. These programs last from 3 to 4 years and include on-the-job training in all the phases of maintaining and repairing farm equipment and related classroom instruction. Upon completion of an apprenticeship program, trainees become qualified mechanics.

A small number of farm equipment mechanics have also received training in programs approved under the provisions of the Manpower Development and Training Act. Typically, these programs last between 29 and 56 weeks and include training in basic electricity, transmissions, welding, hydraulics, and diesel engines. Trainees who complete these programs are able to make simple repairs and can qualify as skilled mechanics after some on-the-job experience.

Some farm equipment mechanics and trainees receive refresher training in short-term programs conducted by manufacturers of farm equipment. These programs usually last several days. A company representative explains the design and function of equipment, and teaches maintenance and repair on new models of farm equipment.

Employers prefer to hire young men with a farm background and an aptitude for mechanical work. They prefer that farm equipment mechanics have high school diplomas, but some employers will still hire young men with less education. In general, employers stress prior experience or training in diesel and gasoline engines, hydraulics, and welding—subjects that may be learned in high schools and vocational schools.

Farm equipment mechanics may advance to shop foremen. Some mechanics open repair shops. Mechanics improve their opportunities for advancement by attending the manufacturer-sponsored training sessions.

### Employment Outlook

Employment of farm equipment mechanics is expected to increase moderately during the remainder of the 1960's and through the 1970's. In addition to the openings that will arise from growth in the field, many job openings will result from the need to replace experienced mechanics who retire, die, or transfer to other fields of work. Deaths and retirements alone are expected to provide about 1,000

job openings each year through the 1970's.

Employment requirements for farm equipment mechanics are mainly determined by the level of farm mechanization. Growing requirements for food should greatly increase the amount of mechanization on farms. Other factors expected to increase farm mechanization include the trend toward large, highly mechanized commercial farms, and the development of improved varieties of farm products that make mechanical harvesting possible. Improved manufacturers' warranties on farm equipment are also expected to increase the demand for farm equipment mechanics by encouraging farmers to service equipment more often.

### Earnings and Working Conditions

National wage data are not available for farm equipment mechanics. However, wage data collected from a small number of employers indicated that in early 1967, average hourly wages of farm equipment mechanics were generally between \$2.10 and \$2.60.

Farm equipment mechanics usually work a 44-hour week which includes 4 hours on Saturday. In the spring, however, they often work 6 to 7 days each week, 10 to 12 hours daily. In winter months, they may work fewer than 40 hours a week. Many mechanics receive from 1 to 2 weeks' paid vacation annually, and 7 paid holidays each year. Most farm equipment mechanics are covered by health plans.

Farm equipment mechanics often travel many miles to repair equipment. When working in the field, they may be exposed to the elements. Mechanics work in repair shops which are usually adequately lighted. They come in contact with grease, gasoline, rust, dust, and dirt. There is danger of injury when they repair heavy parts which are supported on jacks or by hoists. Engine burns and cuts from sharp edges of farm implements are also possible.



The few farm equipment mechanics that belong to labor unions are members of the International Association of Machinists and Aerospace Workers.

### Where To Go for More Information

Information about work opportunities in this trade may be obtained from the local offices of the various State employment services, local farm equipment dealers, and independent service shops. The State employment services can also provide information about programs set up under provisions of the Manpower Development and Training Act of 1962. General information about the occupation can be obtained from:

Farm Equipment Institute,  
850 Wrigley Building N.,  
410 North Michigan Ave., Chicago,  
Ill. 60611.

National Farm and Power Equipment  
Dealers Association,  
2340 Hampton Ave., St. Louis, Mo.  
63139.

## INDUSTRIAL MACHINERY REPAIRMEN

(D.O.T. 625. through 632.281, and 637.  
through 639.281)

### Nature of Work

The great variety of machinery and equipment used throughout American industry is kept in good operating condition by tens of thousands of industrial machinery repairmen—often called *maintenance mechanics*. These skilled workers maintain and repair machinery and other mechanical equipment used in a wide variety of manufacturing establishments. When breakdowns occur, repairmen must quickly determine the cause of the trouble, make the necessary repairs, and return the equipment to proper working order in a minimum amount of time. In this process, they may

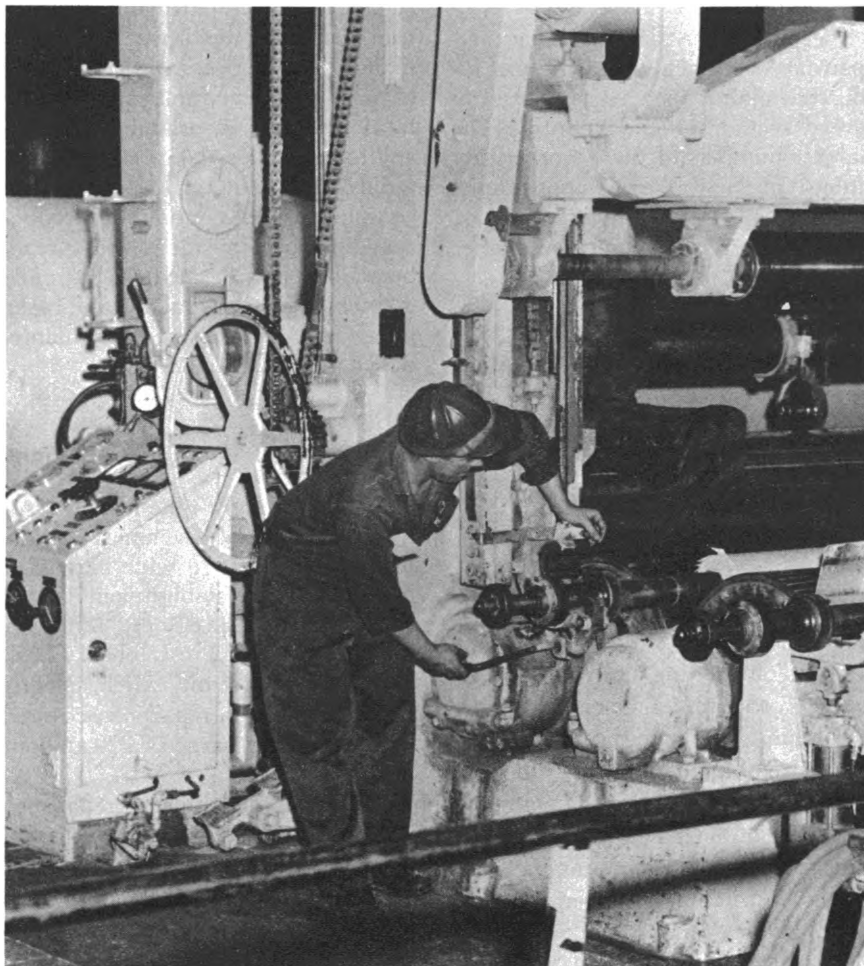
completely or partly disassemble a machine in order to repair or replace defective parts. After the machine is reassembled, they make the necessary mechanical adjustments to insure its proper operation.

When not engaged in repairing machinery, much of a repairman's time is spent in preventive maintenance. By regularly inspecting the equipment, oiling and greasing machines, and cleaning and repairing parts, he prevents trouble which could cause breakdowns later. He also may keep maintenance records of the equipment he services.

The types of machinery on which industrial machinery repairmen work depend to a great extent on the particular industry in which they are employed. For example, in the apparel industry, these skilled workers may

repair industrial sewing machines. They may take sewing machines apart in order to repair belts, adjust treadles, or replace motor bearings. In printing and publishing establishments, skilled industrial machinery repairmen may maintain and repair equipment such as printing presses and folders.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They may also use parts catalogs to order replacements for broken or defective parts. When replacement parts are not readily available or the situation demands quick action to return a machine to production, repairmen may sketch a part that may be fabricated by the plant's machine shop.



Industrial machinery repairmen inspect and adjust papermaking machine.

Industrial machinery repairmen use wrenches, screwdrivers, pliers, and other handtools, as well as portable power tools. They also may use welding equipment in repairing broken metal parts.

### Where Employed

Industrial machinery repairmen work in almost every industrial plant that uses large amounts of machinery and equipment. However, a majority of the more than 150,000 repairmen estimated to be employed in early 1967 worked in the following industries: Food and kindred products, primary metals, machinery, chemicals, fabricated metal products, and transportation equipment. Many repairmen were also employed in the paper, electrical machinery, and rubber industries.

Because industrial machinery repairmen work in a wide variety of industrial plants, they are employed in every section of the country. The largest numbers of these workers are found in New York, Pennsylvania, California, Ohio, Illinois, Michigan, New Jersey, Massachusetts, and other heavily industrialized States.

### Training and Other Qualifications

Most workers who become industrial machinery repairmen start as helpers and pick up the skills of the trade informally through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both on-the-job training and related classroom (or correspondence school) instruction. Apprentices learn the use and care of the tools of the trade, and the operation, lubrication, and adjustment of the machinery and equipment which they will maintain. Classroom instruction is given in shop mathematics, blueprint reading, safety, 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 also are necessary, because industrial machinery repairmen are sometimes required to lift heavy objects or do considerable climbing in order to repair equipment located high above the floor.

### Employment Outlook

Employment of industrial machinery repairmen is expected to increase moderately through the 1970's. In addition to employment growth, thousands of job openings will result from the need to replace experienced mechanics who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to result in about 3,200 job openings annually.

The rise in employment of industrial machinery repairmen is expected mainly because of the anticipated use of more machinery and equipment to fabricate, process, assemble, inspect, and handle industrial production materials. In addition, as automatic equipment and continuous production lines become more widespread, breakdowns will lead to possible greater losses of production and make repair work and preventive maintenance more essential.

### Earnings and Working Conditions

Average straight-time hourly earnings of industrial machinery repairmen employed by a wide variety of manufacturing establishments in 82 metropolitan areas in 1965-66, ranged from \$2.32 in Lubbock, Tex., to \$3.67 in Detroit, Mich. Nearly three-fifths of the repairmen covered by these surveys earned \$3.20 an hour or more.

Industrial machinery repairmen are not usually affected by seasonal changes in production. During slack periods, when some production workers are laid off, repairmen are often retained. Many companies use machine repairmen to do major repair

and overhaul jobs during such periods.

Because motors and other parts of machines are not always readily accessible, maintenance mechanics may work in stooped or cramped positions in limited quarters or from the tops of ladders. Industrial machinery repairmen are subject to common shop injuries such as cuts and bruises. However, accidents have been reduced by the use of goggles, metal-tip shoes, safety helmets, and other protective devices. Repairmen must frequently work on dirty and greasy equipment. Lighting and ventilation are usually good.

Most industrial machinery repairmen belong to labor unions. Some of the unions to which these workers belong are the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electrical, Radio and Machine Workers. Most employer-union contracts covering industrial machinery repairmen provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

### INSTRUMENT REPAIRMEN

(D.O.T. 710.131; 710.281; 729.281; 823.281; and 828.281)

#### Nature of Work

Instrument repairmen install and service the complex industrial and scientific instruments that measure, record, or control heat, electricity, pressure, flow of liquids, chemical composition, and other variables. Instruments serviced by these workers are used in refining oil, guiding airplanes and missiles, generating electricity, conducting laboratory experiments, manufacturing steel, and in

hundreds of other activities. Instrument repairmen (also called *instrument mechanics*, *instrument maintenance men*, *instrument men*, and *instrument technicians*) sometimes specialize in particular kinds of instruments. For example, they may service either electronic, hydraulic, or pneumatic instruments. However, most repairmen are able to service all types of instruments.

To locate instrument trouble, repairmen first determine that the trouble is in the instrument and not in other equipment. They disassemble malfunctioning instruments and examine and test mechanisms and circuitry for defects. They use testing equipment such as pressure and vacuum gages, speed counters, and electrical measuring instruments; for example, voltmeters, oscilloscopes, ammeters, and potentiometers. They compare the readings shown on such testing equipment with the readings that would be shown if the instruments were operating properly.

Instrument repairmen work with instruments at the site of the trouble or in specially equipped shops. They may do major overhauls, replace worn or damaged parts, or make minor repairs such as resoldering loose connections. They use handtools such as screwdrivers, wrenches, pliers, and soldering irons, and bench tools such as jewelers' lathes, pin vises, small buffer grinders, and ultrasonic cleaners for small metal parts. In some companies, instrument repairmen operate drill presses, grinders, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. As guides in their work, instrument repairmen frequently use instruction books and maintenance manuals that describe how to install, operate, and maintain instruments. They also use schematic diagrams, assembly drawings, and blueprints. When instruments are reassembled, repairmen give them final checks for accurate operation.

Instrument repairmen keep maintenance schedules which enable them to look for and correct defects which



Repairman uses soldering iron to repair recording instrument.

could cause breakdowns resulting in production losses. They also clean, lubricate, and adjust the instruments.

Some instrument repairmen install and test new instruments and advise operators on how to use and care for them. Sometimes they modernize older instruments by putting in new parts. Highly skilled instrument repairmen may assist scientists and engineers in research and development laboratories. They select and arrange instruments for tests and experiments. Occasionally, they are called upon to modify instruments to meet special requirements or to get better results. (Instrument technicians may also perform some of these duties. Technicians are discussed elsewhere in the *Handbook*.)

### Where Employed

About 80,000 instrument repairmen were employed in early 1967, primarily by gas and electric utilities; by petroleum and chemical plants; by manufacturers of instruments, pulp and paper, metals, rubber, missiles, and automobiles; and by airlines. Several thousand repairmen worked for Federal agencies, mainly the Air Force, Navy, and Army.

### Training, Other Qualifications, and Advancement

To become a fully qualified instrument repairman usually takes at least 4 years of on-the-job training and study. However, this time may vary considerably depending upon individual ability, previous experience and training, and the complexity of the instruments being serviced.

Instrument repairmen are often hired as trainees or chosen from among plant workers. They learn their trade either informally by working with experienced men or in formal training programs. In addition to actual work experience, formal training programs include specialized courses such as instrumentation theory, mathematics, blueprint reading, and process theory. These courses may be taken by correspondence or at local schools during or after working hours.

Some young men train for instrument repair work in technical institutes and junior colleges. The programs offered by these schools last about 2 years and emphasize basic engineering courses, such as science and mathematics. As instruments become more complex, technical school training will become increasingly important and young men with this training will have a better chance for advancement.

A few instrument repairmen start as apprentices. Apprenticeship programs, which generally last 4 years, emphasize on-the-job training in repairing and maintaining instruments. Apprentices also study mathematics, physics, electronics, chemistry, blueprint reading, instrumentation theory, and process theory.

Armed Forces technical schools also offer training in instrument servicing. Young men who expect to enter the Armed Forces may wish to investigate opportunities for training and work experience while in military service. Skills acquired in this way may qualify men for civilian jobs as instrument repairmen and for other maintenance occupations.

Several instrument manufacturers offer specialized training to experienced instrument repairmen employed by the companies that buy their products. These training courses last from 1 week to 9 months, depending upon the number and complexity of the instruments that the workers are learning to service. Courses are given in theory, maintenance, and operation of the instruments produced by these manufacturers. Students learn to check instruments step by step. They also learn where to find further information about instrument servicing.

Men hired as trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electricity, electronics, machine-shop practice, and blueprint reading are considered particularly useful. Some employers give tests to applicants to determine their mechanical or electrical aptitude. Building and maintaining a ham radio station, or hi-fi set, is good experience for a young man planning to become an instrument repairman.

Instrument repairmen who meet the public are expected to be neat in appearance and to get along well with people. Other important qualifications include the ability to work alone with little supervision and to perform a variety of duties often characterized by frequent change. Instrument repairmen must be able to evaluate data revealed by tests and observations, and be able to work to precise standards and tolerances. Good eye-hand coordination and finger dexterity are needed when handling delicate instrument parts.

Very skilled instrument repairmen with supervisory ability may become group leaders or foremen in maintenance or assembly departments. Some may advance to positions as service representatives in the branch offices of instrument manufacturing companies. A few instrument repairmen become engineering assistants. Because the use of electronic components in instruments is expected to

increase, a basic knowledge of electronics should help young men toward advancement.

### Employment Outlook

The number of instrument repairmen is expected to increase very rapidly during the remainder of the 1960's and throughout the 1970's. In addition to job openings resulting from the growth in employment, many job opportunities will arise from the need to replace experienced repairmen who transfer to other lines of work, retire, or die. Deaths and retirements alone are expected to result in more than a thousand job openings annually.

More instrument repairmen will be needed in the years ahead because the use of instruments will expand rapidly as manufacturing becomes more automated, industrial output expands, research and development activities grow, and as new uses are found for instruments. For example, more instruments will be needed to help produce larger quantities of chemicals, petroleum, food, paper, and electricity; many more kinds of new, complex instruments will be needed for our space programs; greater numbers of instruments will be used in research laboratories; and instruments will be increasingly used by hospitals to supply diagnostic information to medical specialists.

### Earnings and Working Conditions

Information obtained from a number of union-management agreements in the pulp, paper, and paperboard industry and from several chemical and petroleum companies indicates that most instrument repairmen in early 1967 had wage rates between \$3.25 and \$3.70 an hour. Those specializing in electronic instruments or engaged in research and development work may receive higher wages than other instrument repairmen. Some highly skilled instrument repairmen were paid rates of more than \$4

an hour. Instrument repairmen employed by Federal agencies in Washington, D.C., in 1966 were paid from \$3.23 to \$3.61 an hour, about the same rates received by most nongovernment repairmen.

Most instrument repairmen work a 40-hour, 5-day week. Those employed in petroleum refineries and chemical plants which operate 24 hours a day and 7 days a week may work on any of three shifts or rotate among shifts. Repairmen may also be called to work on Sundays and holidays with emergency crews. They receive premium pay for night and holiday work, and most companies provide holiday and vacation pay. Many companies provide additional benefits such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions.

Instrument repairmen may service instruments on factory floors amid noise, oil, and grease. They may also work at benches in quiet, clean, well-lighted repair shops. In some industries, such as chemical, petroleum, and steel, repairmen may be required to work outdoors in all kinds of weather. Those employed by instrument manufacturers may have to travel often.

Many instrument repairmen belong to unions, including the International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; and Utility Workers Union of America.

### Where To Go for More Information

The local office of the State employment service may be a source of information about the Manpower

Development and Training Act, apprenticeship, and other programs that provide training opportunities for those wishing to enter this occupation. Additional information about training, as well as employment opportunities in the field of instrumentation, may be obtained from:

Instrument Society of America,  
530 William Penn Pl., Pittsburgh,  
Pa. 15200.

Scientific Apparatus Makers Association,  
Recorder-Controller Section,  
370 Lexington Ave., New York, N.Y.  
10017.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

## MAINTENANCE ELECTRICIANS

(D.O.T. 825.281 and 829.134 and .281)

### Nature of Work

Maintenance electricians (electrical repairmen) maintain and repair many different types of electrical equipment. In addition, they sometimes modify and install electrical equipment such as motors, transformers, generators, controls, instruments, and lighting systems used in industrial, commercial, and public establishments.

A large part of an electrician's work is preventive maintenance—periodic inspection of equipment to find and repair defects before breakdowns occur. When trouble does develop, he must find and repair the faulty circuit or equipment quickly in order to prevent costly production losses and inconvenience. In emergencies, he may advise management whether immediate shutdown of equipment is necessary, or if continued operation would be hazardous.

In his daily work, the maintenance electrician does many different things.



Electricians install new circuits.

For example, he may make repairs by replacing units or parts such as wiring, fuses, circuit breakers, coils, or switches. While doing repair or installation work, the electrician may connect wires by splicing or by using mechanical connectors. He may measure, cut, bend, thread, and install conduits through which wires are run to outlets, panels, and boxes. He also may adjust equipment controls and check and adjust instruments.

The maintenance electrician uses such devices as test lamps, ammeters, volt-ohm meters, and oscilloscopes in testing electrical equipment and wiring. He sometimes works from blueprints, wiring diagrams, and other specifications. He may make mathematical computations to determine the current carrying capacities of electrical wiring and equipment. Maintenance electricians use pliers, screwdrivers, wire cutters, drills,

reamers, conduit bending and threading tools, and other hand and power tools.

Although all maintenance electricians have the same basic skills, the nature of their work depends largely on the size of the plant and the particular industry in which they work. In manufacturing plants, these workers usually maintain the electrical equipment used in the manufacture of a particular product. For example, steel mills and aluminum plants require a large number of electricians to maintain the electrical and electronic equipment used to power and control rolling mills, presses, and other production machinery. In plants that use large amounts of electrical equipment, electricians may specialize in the maintenance of a particular type of equipment, such as motors, welding machines, or transformers. In small plants, electricians

are usually responsible for all types of electrical repair work. Maintenance electricians employed in large office buildings, apartment houses, and hospitals maintain lighting systems and other electrical equipment, such as that used in air-conditioning systems.

### Where Employed

An estimated 235,000 maintenance electricians were employed throughout the country in early 1967. More than half of these craftsmen were engaged in servicing the equipment and machinery used in manufacturing plants. Large numbers of these workers were employed by manufacturers of transportation equipment, primary metal products, electrical and nonelectrical machinery, chemicals, and paper products.

Nonmanufacturing firms that employed large numbers of maintenance electricians included those in the transportation, communications, and public utilities industries; wholesale and retail trade; and mining. Federal, State, and local governments also employed many of these skilled workers.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Skilled workers in this occupation have the advantage of being able to transfer to maintenance electrician jobs in many different industries. After some additional training, they may also qualify for construction electrician jobs.

### Training, Other Qualifications, and Advancement

Maintenance electricians can learn the skills of their trade through formal apprenticeship programs or by accumulating experience through informal on-the-job training. However, training authorities generally agree that apprenticeship programs give the workers more thorough knowledge of

the trade and greater job opportunities during their working life.

The apprenticeship program for maintenance electricians usually lasts 4 years. Apprentices are given on-the-job training and related technical classroom instruction in subjects such as mathematics, electrical and electronic theory, and blueprint reading. Training may include motor repair, wire splicing, commercial and industrial wiring, installation of light and power equipment, installation and repair of electronic controls and circuits, and welding and brazing.

A young man employed in a plant as a helper to a skilled maintenance electrician may gradually acquire the skills of this craft by observing the electrician and working under his instructions. Others learn the trade by working in the maintenance department of a plant and picking up some of the job fundamentals. By moving from job to job, they eventually acquire sufficient experience to qualify as skilled workers. However, it generally takes more than 4 years to become a maintenance electrician through informal on-the-job training.

A young man interested in becoming a maintenance electrician should include courses in mathematics (such as algebra and trigonometry) and basic science in his high school or vocational school curriculum. Because the electrician's craft is subject to constant change, many experienced electricians must continue to acquire technical knowledge and learn new skills. For example, some maintenance electricians who entered the trade some years ago must now learn basic electronics in order to service the new electronic equipment being introduced in the Nation's industrial establishments and large commercial and residential 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. These young men also need good color vision because electrical wires are frequently identified by their different colors.

Although great physical strength is not essential, agility and good health are important.

All maintenance electricians should be familiar with the National Electric Code; some must be familiar with local building codes. A growing number of cities and counties require maintenance electricians to be licensed. An electrician can obtain a license by passing a comprehensive examination that tests his knowledge of electrical theory and its application.

Skilled maintenance electricians may become foremen who supervise the work of other maintenance electricians or other maintenance personnel. Occasionally, they may advance to jobs such as plant electrical superintendent or plant maintenance superintendent.

### Employment Outlook

Employment of maintenance electricians is expected to increase slowly during the remainder of the 1960's and through the 1970's. Most openings will stem from the need to replace workers who retire, die, or transfer to other fields of work. Retirements and deaths alone will result in about 4,000 job openings annually. In addition, a few thousand job openings are expected each year because of the growing volume of electrical and electronic equipment in use in industry.

### Earnings and Working Conditions

In general, the earnings of maintenance electricians compare favorably with those of other skilled workers. The average straight-time hourly earnings of maintenance electricians in establishments in 80 cities and areas in 1965-66 ranged from about \$2.35 in Greenville, S.C., to \$3.97 in Midland-Odessa, Tex. In about four-fifths of the cities surveyed, however, average straight-time hourly earnings for these craftsmen ranged from \$2.94 to \$3.67.

In establishments that operate an apprenticeship program, apprentices start at about 60 percent of the journeyman's basic hourly pay rate. They receive increases every 6 months, rising to 85 or 90 percent of the journeyman's rate during the last year of apprenticeship.

During 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, surrounded by the noise, oil, and grease of machinery. Maintenance electricians may be called upon to climb ladders, work on scaffolds, or work in awkward or cramped positions when repairing or installing electrical equipment.

Because maintenance electricians often work around high-voltage industrial equipment, they must be alert and accurate in performing their duties. Errors in wiring installations could have dangerous consequences both to the electrician and the operating employees. The safety principles that are now part of all electrician training programs have greatly reduced the frequency of accidents. Maintenance electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to handle small electrical fires.

Various labor unions have maintenance electricians in their membership. Many of these craftsmen are members of the International Brotherhood of Electrical Workers. Other unions to which maintenance electricians belong are the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the United Steelworkers of America. Most of the labor-management contracts covering maintenance electricians provide major benefit programs that may include paid holidays and vacations; hospitalization, medical, and surgical in-

surance; life insurance; and retirement pensions.

### Where To Go for More Information

A young man who wishes to obtain further information regarding electrician apprenticeships or other work opportunities in the trade should apply to local firms that employ maintenance electricians; to a local joint union-management apprenticeship committee, if there is one in his locality; or to the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about training opportunities. Some State employment service offices provide such services as screening applicants and giving aptitude tests.

## MILLWRIGHTS

(D.O.T. 638.281)

### Nature of Work

Millwrights are skilled craftsmen whose principal duty is to move and install heavy industrial machinery and other equipment. These workers must have a thorough knowledge of the complex industrial equipment on which they work because it is frequently necessary for them to dismantle, reassemble, and align this equipment in order to move and/or install it. In assembling machinery, millwrights fit bearings, align gears and wheels, attach motors, and connect belts. Millwrights often construct concrete foundations and platforms, or fabricate metal framework, on which machinery is to be mounted. To do this work, they must be able to read blueprints and work with wood, steel, concrete, and other building materials.

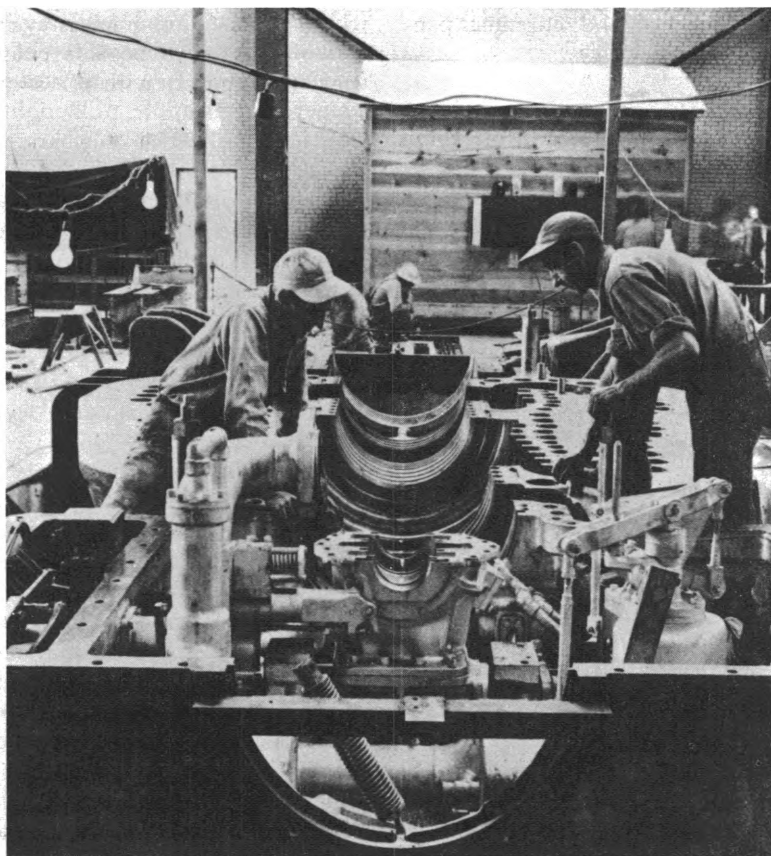
When installing machinery, millwrights use a wide variety of tools and equipment. In moving heavy machinery, for example, millwrights use hoists, cranes, jacks, crowbars, wood blocking, and other assorted rigging devices. In dismantling and assembling equipment, they use wrenches, screwdrivers, pliers, hammers, and various other handtools and portable power tools. In aligning and leveling equipment, they use measuring devices, such as micrometers, calipers, squares, plumb bobs, and leveling instruments.

Millwrights employed by companies doing contract installation work and by construction companies are required to install a wide variety of heavy machinery, including turbines and automatic assembly equipment. Those employed in factories may be responsible for the maintenance and repair, as well as the installation, of the particular types of machinery used in the industry in which they are employed. For example, millwrights sometimes repair and maintain plant equipment, such as conveyors, cranes, hoists, scaffolds, pumps, and blowers. Such work may include replacing worn or broken belts, welding metal parts, and lubricating machinery. Millwrights sometimes work as part of a maintenance team of pipefitters and machinery repairmen to keep industrial equipment in good operating condition.

### Where Employed

The vast majority of the estimated 72,000 millwrights employed in early 1967 worked in manufacturing establishments. The greatest number were employed in primary metals, metalworking industries, paper, lumber, and chemical products firms. Most of the remaining millwrights in the nonmanufacturing sector were employed in the construction industry.

Some millwrights are employed by companies that specialize in moving, installing, and maintaining industrial machinery on a contract basis. Others work for machinery manufacturers



Millwrights check steam turbine installation in power plant.

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 Michigan, Ohio, Pennsylvania, Illinois, New York, and Indiana.

### Training and Other Qualifications

Millwrights learn the trade by acquiring the skills informally or through apprenticeship programs. Those workers who pick up the trade informally usually work as helpers to skilled millwrights over a period of years until they acquire sufficient knowledge and experience to be classified as skilled workers. However, 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 in this trade are given shop training in dismantling, moving, erecting, and repairing machinery and other equipment. They are also trained in floor layout, the installation of machinery and other equipment, carpentry, welding, and the use of structural steel, wood, and concrete. The apprenticeship program includes related classroom instruction in shop mathematics, blueprint reading, hydraulics, electricity, and safety. Many companies require that apprentice applicants be high school graduates between the ages of 18 and 26.

High school courses in science, mathematics, mechanical drawing,

and machine shop practice are useful subjects for young men interested in becoming millwrights. Because millwrights often put together and take apart complicated machinery, mechanical aptitude is important 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

Employment of millwrights is expected to increase slowly through the 1970's. The building of new plants, the addition of new machinery, changes in plant layouts, and the maintenance of increasing amounts of heavy and complex machinery and other equipment are factors expected to increase employment of millwrights.

In addition to new job openings that will be created by industrial expansion and increased mechanization, several thousand workers will be needed annually to replace millwrights who transfer to other lines of work, retire, or die. Retirements and deaths alone are expected to result in about 1,500 job openings annually.

### Earnings and Working Conditions

The earnings of millwrights depend mainly on the area of the country in which they are employed and the type of business in which their employer is engaged. Average straight-time hourly earnings of millwrights employed in manufacturing industries in 46 metropolitan areas surveyed in 1965-66 ranged from \$2.80 in Worcester, Mass., to \$3.65 in Detroit, Mich. More than three-fifths of these workers earned \$3.40 an hour or more.

Millwrights employed by companies doing contract installation work and by construction companies usually have higher hourly wage rates than those employed in manufacturing industries. For example, the mini-



imum average hourly wage rates for millwrights under union-management contracts doing construction work ranged from \$3.85 an hour in Jackson, Miss., to \$5.81 in Newark, N.J., as of July 1, 1966, according to a national survey of building trades workers in 68 large cities.

Wage rates for apprentices generally start at approximately 50 percent of the skilled worker's rate and increase to the journeyman's rate by the end of the training period.

Millwrights, most of whom work in factories, ordinarily work year round. Those who work for construction companies and for companies that manufacture and install machinery, or move and install machinery on a contract basis, may have periods of unemployment between jobs. These workers may frequently be assigned to jobs away from their homes.

The work of millwrights involves certain hazards. For example, there is danger of being struck by falling objects or by machinery that is being moved. There also is the danger of falling from high work places. In addition, millwrights are subject to the usual shop hazards, such as cuts and bruises. Accidents have been reduced by the use of protective devices, such as safety belts, safety hats, eye protection, and shoes with metal tips. Millwrights must frequently work on dirty, greasy equipment.

Most millwrights belong to labor unions, among which are the International Association of Machinists and Aerospace Workers; United Brotherhood of Carpenters and Joiners of America; United Steelworkers of America; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; and the International Union of Electrical, Radio and Machine Workers. Employer-union contracts covering millwrights usually include provisions for benefits such as paid holidays and vacations; hospitalization, medical, and surgical insurance; life insurance; sickness and ac-

cident insurance; and retirement pensions.

### Where To Go for More Information

United Brotherhood of Carpenters and Joiners of America,  
101 Constitution Ave. NW., Wash-  
ington, D.C. 20001.

### TELEVISION AND RADIO SERVICE TECHNICIANS

(D.O.T. 720.281)

#### Nature of Work

Skilled television and radio service technicians use their knowledge of electrical and electronic parts and circuits to install and repair a growing number of electronic products. Of these, television receivers are by far the most prominent; other major electronic products are radios (including home, automobile, and two-way mobile radios), phonographs, hi-fidelity and stereophonic sound equipment, intercommunication equipment, tape recorders, and public address systems. Many service technicians specialize in repairing one kind of equipment; for example, color television receivers or automobile radios.

Most of the skilled work done by television and radio service technicians involves diagnosing trouble in equipment and making necessary repairs and adjustments. Equipment may operate unsatisfactorily, or break down completely, because of faulty tubes; transistors, resistors, and other components; poor connections; aging of parts; and dirt, moisture, heat, and other basic troubles that affect all electronic equipment. When service technicians turn on television receivers or other equipment needing repair, signs of unsatisfactory performance, such as absence or distortion of picture or sound, may indicate

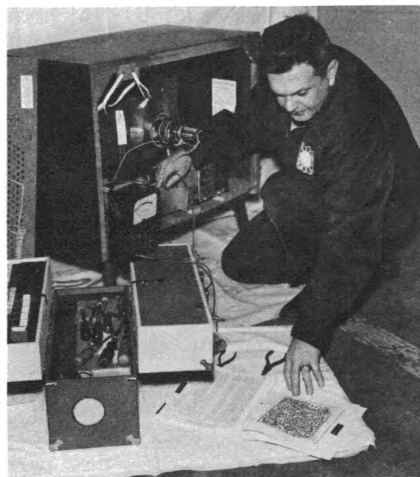
what is wrong. Their job is to check and evaluate each possible cause of trouble, beginning with the simplest and most common cause—tube failure. In other routine checks, they look for loose or broken connections and for parts that are charred or burned, due to excessive current or mishandling.

When routine checks do not locate the cause of trouble, service technicians use meter and electronic test equipment to check suspected circuits. For example, they may measure voltages, until an unusual or irregular measurement indicates that part of the circuitry causing trouble. Commonly used test instruments are vacuum tube voltmeters, multimeters, oscilloscopes, signal generators, and other specialized instruments.

On service calls, service technicians advise customers as to what may be wrong with receivers and whether receivers must be taken to shops for further analysis and repair. If possible, they explain what must be done to repair receivers and estimate the cost of such repairs. After receivers are repaired on the customers' premises, or returned from shops, service technicians explain what has been done. They may further adjust the equipment to put it in proper operating condition.

Work usually done by television and radio service technicians in homes or other places where equipment is used includes making simple electrical checks with a voltmeter, changing tubes, and making necessary adjustments, including focusing the picture or correcting the color balance on a color receiver. Service technicians who make customer service calls carry tubes and other components that are easily replaced in the customer's home. Apprentices or less experienced television service technicians may install or repair antennas on roofs or in attics and run lead in wires from antennas to receivers.

Radios, television receivers, and other equipment small enough to be carried by customers usually are repaired in service shops. Larger tele-



Service technician follows schematic diagram and uses test equipment to check television receiver.

vision receivers are repaired in shops when they develop troubles which appear after receivers have been operating for a few hours, or when the troubles can be located only with the more complex test equipment available in shops.

Television and radio service technicians usually refer to wiring diagrams and service manuals that show connections within receivers, provide adjustment information, and describe causes of trouble associated with unusual symptoms. They must know how to use soldering irons, wire cutters, long-nosed pliers, wrenches, screwdrivers and, sometimes, magnifying glasses when they remove, adjust, or replace parts, components, or complete equipment such as automobile radios.

### Where Employed

About 125,000 television and radio service technicians were estimated to be employed in early 1967, of whom about a third were self-employed. About three-fourths of all service technicians worked in service shops or in stores that sell and service television receivers, radios, and other electronic products. Most of the remaining service technicians were employed by government agencies

and manufacturers, including manufacturers that operated their own service branches.

Television and radio service technicians are employed in almost every city, because the products they service are used everywhere. However, employment of these workers is distributed geographically in much the same way as the Nation's population. Thus, they are employed mainly in the highly populated States and major metropolitan areas.

### Training, Other Qualifications, and Advancement

Training in electronics is required to become a highly skilled television and radio service technician capable of working on various types of electronic equipment. Technical, vocational, or high school training in electronic subjects, mathematics, and physics have helped men to qualify as expert television and radio service technicians. Home study (correspondence school) courses are also helpful. Young men who enter military service may wish to investigate opportunities for training and work experience in servicing electronic equipment, because such experience often is valuable in civilian electronics work, including television and radio servicing. From 2 to 3 years' combined training and on-the-job experience are required to become a qualified television and radio service technician. Men without previous training may be hired as helpers or apprentices if they show aptitude for the work or, like the amateur ("ham") radio operator, have a hobby in electronics.

An important part of the service technicians' training is provided by many manufacturers, employers, and trade associations. Such organizations conduct training programs when new models or new products are introduced and as part of a continuing effort to keep service technicians abreast of the latest technical servicing and business methods. Service

technicians also keep up with technical developments by studying manufacturers' instruction books and technical magazines, and by attending training meetings covering electronics service work.

Programs to train unemployed and underemployed workers for entry jobs in the television and radio service field were in operation in several cities, in early 1967, under the Manpower Development and Training Act. These programs usually lasted from about 6 months to a year. With additional experience or training, which may include apprenticeship, graduates of these programs may become skilled service technicians.

Television and radio service technicians must know how electronic components and circuits work, and why they function as they do. They also must be able to understand technical publications. Other essential qualifications include the ability to manipulate small parts and tools, good hand-eye coordination, normal hearing, and good eyesight and color vision.

Television and radio service technicians who work in large repair shops or service centers may be promoted to assistant foreman, foreman, and service manager. Frequently, they are able to obtain jobs as electronics mechanic or technician in manufacturing industries or government agencies. Those who are employed by manufacturers can advance to higher paying occupations, such as technical writer, sales engineer, design engineer, and service training instructor. In addition, experienced men who have sufficient funds, adequate business management training, and ability may open their own sales and repair shops.

Persons interested in advancing to positions such as electronic technician can improve their opportunities by taking trade school, correspondence, or technical institute courses, or other types of advanced courses in electronic engineering, television engineering, automatic controls, engineering mathematics, and other subjects related to electronics.

In 1967, television and radio service technicians were required to be licensed in several States and cities. To obtain a license, applicants are required to pass an examination designed to test their skill in the use of testing equipment and their knowledge of electronic circuits and components.

### Employment Outlook

Employment of television and radio service technicians is expected to increase rapidly throughout the 1970's. In addition, about 1,400 job openings annually are expected to result from the need to replace experienced workers who retire or die. Transfers to other occupations may provide additional job openings.

Employment of service technicians is expected to increase over the long run along with the growing number of radios, television receivers, phonographs, and other home entertainment products in use throughout the 1970's. Factors that will contribute to this growth include rising population and family formations, and rising levels of personal income. In 1965, more than 9 of every 10 households had one television receiver or more. During the next decade, the number of households with two televisions receivers or more is expected to increase significantly, mainly because of the growing demand for color and lightweight, portable television receivers. Other consumer electronics products that are expected to be used increasingly include stereophonic radios, phonographs, tape recorders, AM-FM radios, and portable transistor radios. New consumer products, such as home video tape recorders, as well as improved styling and design of existing products, will also stimulate demand. Greater use of nonentertainment products, such as closed-circuit television, two-way radios, and various medical electronic devices, is also expected. For example, closed-circuit television is being used increasingly to monitor production process in

manufacturing plants, and to bring educational programs into classrooms.

In recent years, technological improvements in television receivers and radios (such as the use of transistors in place of tubes) have reduced the amount of service this equipment requires. Technological improvements will continue to reduce servicing requirements in the years ahead and may tend to slow employment growth. However, technological developments will increase employment opportunities for those television and radio service technicians who have theoretical as well as practical knowledge of electronic circuits and know how to use the latest test equipment. Servicing television receivers, radios, and related electronic equipment is a changing field, with constant technological advances. Service technicians will have to keep their training up to date to cope with such changes.

### Earnings and Working Conditions

National earnings data are not available for television and radio service technicians. However, information obtained in major metropolitan areas from proprietors of independent service shops and manufacturers who operate service centers indicated that, in early 1967, many service technicians in entry jobs had straight-time weekly earnings ranging from about \$70 to \$100; many experienced service technicians had weekly earnings ranging from about \$110 to \$180. Some "inside" (shop) service technicians received higher weekly earnings than "outside" (field) technicians.

Television and radio service technicians employed in local service shops or dealer service departments commonly work a 6-day, 48-hour week. In large shops, including manufacturers' service branches, they usually work a basic 40-hour week. Service technicians often work more than 8 hours a day and receive higher rates of pay for overtime work. Some employers of television and radio serv-

ice technicians provide paid vacations and holidays after a specified length of service. Many also provide or help pay for health and life insurance benefits. Some shops are unionized.

Service on television, radio, and other home entertainment products is performed in shops and homes where working conditions are usually pleasant. Inside men work at benches, normally provided with stools. Outside men may spend several hours a day driving between shops and customers. Some physical strain is involved in lifting and carrying receivers. Perhaps the greatest hazard is the risk of falling from roofs while installing or repairing antennas. Electrical shock is another hazard, but it has rarely caused serious injury.

### Where To Go for More Information

Additional information about jobs in television servicing may be obtained from local service technicians, local dealers who sell and service television receivers and other electronic equipment, local television service associations, and manufacturers who operate their own service centers. Technical and vocational schools that offer courses in television and radio repair, or electronics, can provide helpful information about training. In addition, the local office of the State employment service would be a source of information about the Manpower Development and Training Act and other programs that provide training opportunities.

### TRUCK MECHANICS AND BUS MECHANICS

(D.O.T. 620.281)

#### Nature of Work

Truck and bus mechanics keep trucks and buses, which play a key role in the Nation's transportation

system, in good running condition. Truck mechanics work on large intercity trucks, as well as on medium and small trucks used in local hauling. They may repair heavy trucks used on construction and mining sites. Bus mechanics maintain a variety of buses, ranging from small ones used in local transit to large transcontinental buses. Although many of the mechanical parts of large trucks and buses are basically the same as automobile parts, truck mechanics and bus mechanics repair large engines, complex transmissions and differentials, air-brakes, and other components that are different from those in automobiles.

Mechanics employed in the shops of organizations that maintain and repair their own vehicles may spend much of their time in performing preventive maintenance. In these shops, each vehicle is serviced and inspected

periodically. For example, during a periodic maintenance check, mechanics inspect brake systems, steering mechanisms, wheel bearings, universal joints, and many other parts, and make needed repairs or adjustments. By performing preventive maintenance, mechanics help assure safe vehicle operating condition, check wear and damage to parts, and reduce costly breakdowns.

When trucks and buses do not operate properly or when breakdowns occur, these workers determine the cause of the trouble and make the necessary repairs. In large repair shops, mechanics may specialize in one or a few types of repair. For example, some mechanics do mostly major engine or transmission work. If an engine needs to be rebuilt, the mechanic removes it from the vehicle and disassembles it. He examines parts such as valves, pistons, rods, and

bearings for wear or defects, and replaces or repairs defective parts. Many mechanics specialize in the repair of diesel engines, which are used widely for trucks and buses. Diesel and gasoline engines are similar, but have different fuel and ignition systems. Therefore, a mechanic who has worked only on gasoline engines needs special training before he can qualify as a diesel mechanic. (See statement on Diesel mechanics elsewhere in the *Handbook*.)

Truck mechanics and bus mechanics use common handtools such as screwdrivers, pliers, and wrenches; power and machine tools such as pneumatic wrenches, drills, grinders, and lathes; special purpose tools such as pump seal installers and transmission jacks; and welding and flame cutting equipment. They also use various types of testing devices to help locate malfunctions. The latter may include relatively simple testing devices such as voltmeters, coil testers, and compression gages, and complicated analytical equipment such as oscilloscopes and dynamometers. Mechanics use hydraulic jacks and hoists to lift and move heavy parts.

When doing heavy work, such as removing engines and transmissions, two mechanics may work as a team, or a mechanic may be assisted by an apprentice or helper. Mechanics generally work under the supervision of a shop foreman or service manager.

### Where Employed

A large proportion of the estimated 91,000 truck mechanics employed in late 1966 worked for firms that own fleets of trucks. Fleet owners include trucking companies, and companies that haul their own products, such as dairies, bakeries, and construction companies. Other employers of truck mechanics include truck dealers, truck manufacturers, independent truck repair shops, firms that rent or lease trucks, and Federal, State, and local governments.

The large majority of the estimated 17,000 bus mechanics em-



Truck mechanic makes final adjustments before new truck leaves factory.

ployed in late 1966 worked for local transit companies and intercity buslines. Bus manufacturers employed a relatively small number of bus mechanics.

Truck mechanics and bus mechanics are employed in every section of the country, but most of them work in large towns and cities where trucking companies, buslines, and other fleet owners have large repair shops.

### Training, Other Qualifications, and Advancement

Most workers who become truck or bus mechanics learn their skills informally on the job. In shops where fleets of trucks and buses are serviced beginners usually perform such tasks as cleaning, fueling, and lubrication. They may be required to drive vehicles in and out of the shop. As beginners gain experience and as vacancies become available, they usually are promoted to mechanic helpers. In some other shops, young persons—especially those who have prior automobile repair experience—are hired as helpers. Helpers learn mechanics' skills by assisting experienced mechanics in inspection and repair work. Most helpers are able to make minor repairs after a few months' experience, and are allowed to handle increasingly difficult jobs as they prove their ability. Generally, 3 to 4 years of on-the-job experience is necessary to qualify as an all-round truck or bus mechanic. Additional training may be necessary for mechanics who wish to specialize in repairing diesel engines.

Most training authorities, including joint labor-management committees for the truck transportation industry, recommend a formal 4-year apprenticeship as the best way to learn these trades. Typical apprenticeship programs for truck and bus mechanics consist of approximately 8,000 hours of shop training and at least 576 hours of related classroom instruction. Frequently, these programs include training in both diesel and gasoline engine repair.

For entry jobs, employers generally look for young men who have mechanical aptitude and who are at least 18 years of age and in good physical condition. Completion of high school is an advantage in getting an entry mechanic job because most employers believe it indicates that a young man can "finish a job" and has potential for advancement.

Where the mechanic's job duties include driving trucks or buses on public roads, employers may require applicants to have or be able to obtain a State chauffeur's license. If the employer is engaged in interstate transportation, the applicant also may be required to meet qualifications for drivers established by the U.S. Department of Transportation. He must be at least 21 years of age, able bodied, have good hearing and at least 20/40 eyesight with or without glasses. He must be able to read and speak English; have at least 1 year's driving experience (which may include driving private automobiles); and have a good driving record.

Young men who are interested in becoming truck or bus mechanics can gain helpful experience by taking high school or vocational school courses in automobile repair. Courses in science and mathematics are helpful since they give a young man a better understanding of how large trucks and buses operate. Courses in diesel repair provide valuable related training. Practical experience in automobile repair gained from working in a gasoline service station, training in the Armed Forces, and working on automobiles as a hobby is valuable also.

Most employers require mechanics to have their own handtools. Experienced mechanics may have several hundred dollars invested in tools. Employers ordinarily will hire beginners who do not own handtools, but they are expected to accumulate them as they gain experience.

Employers sometimes send experienced mechanics to special training classes conducted by truck, bus, diesel engine, and parts manufacturers. In these classes, mechanics learn to re-

pair the latest types of equipment, or receive special training in such subjects as diagnosing engine malfunctions.

Experienced mechanics who have supervisory ability may advance to shop foremen or service managers. Truck mechanics who have sales ability sometimes become truck salesmen. Some mechanics may open their own gasoline service stations or independent repair shops.

### Employment Outlook

Employment of truck mechanics is expected to increase by a few thousand each year through the 1970's, as a result of significant increases in the transportation of freight by trucks. More trucks will be needed for both local and intercity hauling as a result of increased industrial activity, continued decentralization of industry, and the continued movement of the population to the suburbs. In addition to the job openings expected to occur as a result of employment growth, about 1,400 openings will occur annually because of job vacancies resulting from deaths and retirements. Opportunities to enter this occupation will also occur as some mechanics transfer to other lines of work.

A few hundred job opportunities for bus mechanics are anticipated each year through the 1970's as a result of the need to replace experienced mechanics who retire, die, or transfer to other fields of work, even though the number of bus mechanics employed during this period is expected to remain at approximately the present level. Continued growth in intercity bus travel is anticipated as a result of growing population, new and improved highways, and further curtailment or elimination of railroad passenger service in many areas. However, the favorable employment effect of increasing intercity bus travel is expected to be offset by a decline in local bus travel as a result of the growing use of private automobiles in city and suburban areas.

## Earnings and Working Conditions

According to a survey covering 84 cities in late 1965 and early 1966, mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had average straight-time hourly earnings of \$3.21. Average hourly earnings of these workers in individual cities ranged from \$2.46 in Chattanooga, Tenn., to \$3.93 in San Francisco-Oakland, Calif.

Apprentices' wage rates generally start at 50 percent of skilled workers' rates and are increased about every 6 months until a rate of 90 percent is reached during the last 6 months of the training period.

Most mechanics work between 40 and 48 hours per week. Because many truck and bus firms provide service around the clock, they employ mechanics on evening and night shifts, and on weekends. Mechanics usually receive a higher rate of pay when they work overtime or on evening or night shifts, weekends, or holidays. A large number of employers provide holiday and vacation pay; many pay part or all of the cost of financing employee health and life insurance programs and other employee benefits. Laundered uniforms are furnished free of charge by some employers.

Truck mechanics and bus mechanics are subject to the usual shop hazards, such as cuts and bruises. If proper safety precautions are not taken, there is also some danger of injury when repairing heavy parts supported on jacks and hoists. Mechanics handle greasy and dirty parts. They often have to stand or lie in awkward or cramped positions for extended periods of time when repairing vehicles. Mechanics' work areas are usually well lighted, heated, and ventilated, and many employers provide locker rooms and shower facilities for their employees. Although most work is performed indoors, mechanics occasionally make repairs outdoors when breakdowns occur.

Many truck mechanics and bus mechanics are members of labor unions. These include the Interna-

tional Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

## Where To Go for More Information

For further information regarding work opportunities for truck or bus mechanics, inquiries should be directed to local employers, such as trucking companies, truck dealers, or bus lines; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act of 1962, apprenticeship, and other programs that provide training opportunities. General information about the work of truck mechanics and apprenticeship training may be obtained from:

American Trucking Associations,  
Inc.,  
1616 P St. NW., Washington, D.C.  
20036.

## VENDING MACHINE MECHANICS

(D.O.T. 639.381)

### Nature of Work

The convenience of automatic, 24-hour merchandising and the great variety of items provided by vending machines have resulted in a nationwide industry and increasing job opportunities for skilled mechanics who maintain and repair these machines. The familiar gum ball, cigarette, or other mechanical, gravity-operated

dispensing device no longer typifies modern vending machines. Today, vending machines include growing numbers of complex, electrically operated machines that dispense hot canned foods and ready-to-eat dinners, and brew individual cups of coffee flavored to taste.

Most vending machine mechanics work both in repair shops maintained by operators (companies that install and service vending machines) and at locations where machines are installed, such as schools, office buildings, factories, theaters, transportation terminals, and hospitals. Some work only in repair shops; others work only in the field, traveling by car or small truck from one location to another to make machine repairs.

In the repair shops, mechanics repair complex vending machine components, such as water pumps, motors, and relays, and overhaul machines returned from locations by replacing worn or damaged parts. They may also assemble new machines in the shop, following instructional materials supplied by the manufacturer. After the machines are assembled, they are filled with products or ingredients and test run. When working on relatively complex machines—for example, beverage dispensing machines—mechanics check to see that the machines dispense proper quantities of ingredients and that their refrigerating or heating units operate properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise-delivery systems. They also test coin and change-making mechanisms. After the machines are test run and necessary adjustments are made, mechanics disconnect, empty, clean, and otherwise prepare the machines for removal to designated locations. When installing a machine on location, mechanics make the necessary water and electrical connections and recheck the machines for proper operation.

When a machine on location is reported to be defective, the mechanic

first determines the cause of the trouble. He inspects the machine for obvious troubles, such as loose electrical wires, malfunctions of the coin mechanism, and water and other leaks. He may test the machine's components to isolate the defective parts. After the mechanic locates the cause of the trouble, he may remove and repair, or replace the defective parts, either on location or in his employer's service shop.

Preventive maintenance—avoiding trouble before it starts—is another major responsibility of the mechanic. For example, he periodically cleans electrical contact points, lubricates mechanical parts, and adjusts machines to perform properly. Both in the service shop and on location, mechanics use handtools, such as wrenches, screwdrivers, hammers, pliers, pipe cutters, electrical circuit testers and soldering irons. In the service shop, they may also use power tools, such as grinding wheels, saws, and drills.

Vending machine mechanics use operating and troubleshooting manuals in the repair of machine systems and components. They must know how and when to do soldering or brazing in order to repair piping systems; how to read diagrams of electrical circuits; and how to test electrical circuits and components. Mechanics who install and repair food vending machines must know State public health and sanitation standards as well as those established under local plumbing codes. They must also know and comply with safety procedures, especially when working with electricity and gas and when lifting heavy objects.

Repairmen are required to do some clerical work. For example, they may fill out reports, prepare repair-cost estimates, keep parts inventories, and order parts. If they are chief mechanics, they prepare work schedules for other mechanics. Mechanics employed by small operating companies frequently service as well as repair

machines. These combination "repair-routemen," are responsible for periodically stocking machines, collecting money, filling coin and/or currency changers, and keeping daily records of merchandise distributed. (Additional information about vending machine routemen is included in the statement on routemen elsewhere in the *Handbook*. See index for page numbers.)

### Where Employed

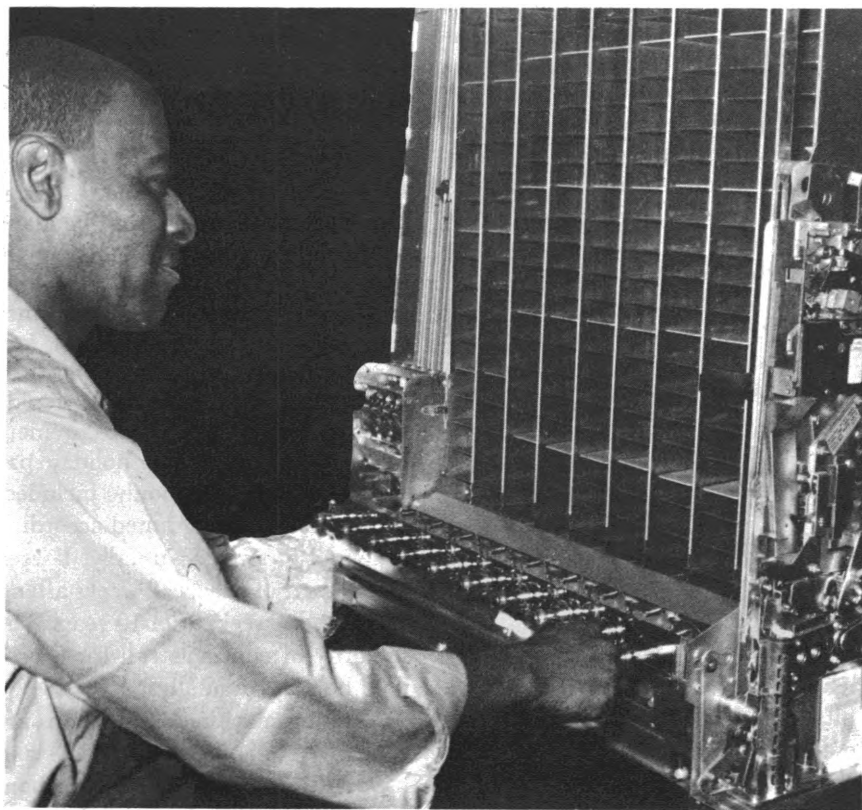
In early 1967, about 16,000 mechanics were employed to maintain and repair the more than 4 million vending machines in use. Vending machine repairmen work mainly for operators who place machines in selected locations and provide necessary services, such as cleaning, stocking, and repairing. Some repairmen are also employed by beverage companies which have coin operated machines on location. Although vending machine operators are located throughout the country, most mechanics are employed in the major industrial and commercial centers where there are large numbers of vending machines on location.

Some highly-skilled mechanics are employed by vending machine manufacturers as instructors. These instructors explain technical innovations in machines to repair personnel employed by vending operators and teach them to repair new machines. They provide such instruction either in manufacturers' service divisions in major metropolitan areas or in operators' repair shops.

### Training, Other Qualifications, and Advancement

Young men usually enter this trade as general shop helpers. If the shop helpers show promise as mechanics, they may become trainees. Some young men are hired directly as trainees.

Mechanic trainees acquire skills of the trade through on-the-job train-



Mechanic inspects dispensing mechanism.

ing—observing, working with, and receiving instruction from experienced mechanics. Sometimes, trainees attend manufacturer-sponsored training sessions, which emphasize the repair of new and complex machines. Employers usually pay the wages and expenses of their trainees during the period of training, which may last from a few days to several weeks. Experienced mechanics may also attend these sessions. Because vending machines are increasing in complexity, some operators encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity. At least part of the tuition and book expenses for these courses is paid for by the employers.

The duration of on-the-job training varies with the individual's capabilities and the extent of his prior education. Although it may take from 1½ to 2 years for a trainee to become skilled in his work, within 6 to 9 months he usually can handle simple repair jobs and may be sent out alone on trouble calls. Mechanics are generally "in training" throughout their working lives, since they must constantly increase their working knowledge to deal with new and improved vending equipment.

Many beginners in this trade are high school graduates, although employers generally do not require a high school diploma for employment. High school or vocational school courses in electricity and machine repair help beginners to qualify for entry jobs. Such courses also may help beginners to skip the lowest rung of the job ladder—general shop helper.

Employers require prospective repairmen to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. Other required characteristics are honesty, since coin mechanisms and automatic currency changes are often repaired, and an interest in providing efficient service. Ability to deal tactfully with people is another important personal characteristic that employers look for

when considering applicants. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to senior mechanic or, in large companies, to shop foreman or supervisor. Advancement to service manager, who is responsible for scheduling repair work, is possible for a few mechanics with administrative ability. A few mechanics with initiative and adequate financial backing become independent operators.

### Employment Outlook

Employment of vending machine mechanics is expected to increase moderately throughout the 1970's. In addition, a few hundred job openings will result each year from the need to replace repairmen who retire or die. Other job openings will result from the need to replace repairmen who are promoted or who transfer to other fields of work.

The factors that have spurred the expansion of the automatic merchandising industry in the past are expected to continue to stimulate growth in the industry and increase the demand for the services of qualified vending machine mechanics. Some of these factors are the introduction of new and improved machines that dispense a growing variety of merchandise; convenient, round-the-clock service; and the rising costs of selling low-priced, standard items through conventional procedures. Improvements in currency-changing devices have also stimulated the growth of the industry by making it possible to vend a greater variety of merchandise.

Other factors that will continue to contribute to the industry's growth include an expanding population; rising levels of personal income; movement of industrial plants, schools, hospitals, department stores, and other establishments to the suburbs where restaurants are often inconveniently located; and the rising popularity of light meals and snacks.

### Earnings and Working Conditions

National wage data are not available for vending machine mechanics and trainees. Wage data are available, however, from union-management contracts, in effect in mid-1966, covering a large number of these workers employed by operating companies in 29 States and the District of Columbia. Although these contracts show a very wide range of straight-time hourly pay rates for mechanics, the majority provided for hourly rates between \$2.50 and \$3. Generally, contracts covering mechanics in the Pacific States specified rates higher than \$3 an hour, and those in the Southern States almost \$2.50 an hour. Different hourly rates for shop mechanics and for field (street) mechanics were stipulated in several contracts. In a few, mechanics' rates differed, depending on the complexity of the machines being repaired.

Most vending machine repairmen work an 8-hour day, 5 days a week, and receive premium pay for overtime work. Since vending machines can be operated 24 hours a day, mechanics are frequently required to work at night and on weekends and holidays. Some union-management contracts stipulate higher rates of pay for nightwork and for emergency repair work on weekends and holidays.

Many union-management agreements covering vending machine mechanics include health insurance provisions for hospital, medical, and surgical benefits, usually financed by the employer. Some contracts provide for employer-financed retirement benefits. Vacation and holiday pay provisions are commonly included. Paid vacations are granted according to length of service—usually, 1 week after 1 year of service, 2 weeks after 2 years, and 3 weeks after 10 years. The majority of contracts call for 6 or 7 paid holidays annually.

Vending machine repair shops are generally quiet, well-lighted, and have adequate work space. Mechanics usually perform their tasks while sitting comfortably or standing; how-



ever, when working on machines on location, they may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to such shop hazards as electrical shocks, and cuts from sharp tools and metal objects. Vending machine mechanics who drive trucks to and from location are subject to the usual driving hazards.

Many vending machine mechanics employed in the larger operating companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

### Where To Go for More Information

Further information about work opportunities in this trade can be obtained from local vending machine operators and local offices of the State employment service. Additional information about employment in this field is available from the National Automatic Merchandising Association, 7 South Dearborn St., Chicago, Ill. 60603.

## WATCH REPAIRMEN

(D.O.T. 715.281)

### Nature of Work

The skilled workers who repair, adjust, and regulate watches, clocks, chronometers, and electromechanical and other timepieces are called watch repairmen or "watchmakers." The repairman must have a keen ability to diagnose accurately the cause of trouble, often very difficult to locate in complicated mechanisms. His work requires precise and delicate handling of tiny parts. In repairing a watch, the craftsman first removes the entire "movement" of the watch from the case and examines its working parts,



Repairman uses loupe to examine movement of watch.

such as the hands, dial, and balance wheel assembly, with the aid of a magnifying eyeglass (called a "loupe"). He may then replace the mainspring, hairspring, balance and other wheels, stems and crowns, and hands or broken jewels and adjust improperly fitted wheels and other parts. The parts are cleaned and oiled before dials, hands, case, crystal, and watch band are reassembled.

The development of interchangeable mass-produced watch parts has generally decreased the watch repairman's need for making such parts by hand. However, he must frequently adjust factory-made parts for complicated timepieces to insure a "true" fit.

Watch repairmen use timing machines; cleaning machines, including ultrasonic cleaners; and handtools, such as tiny pliers, tweezers, and screwdrivers. The repair of electric and electromechanical watches and clocks requires the use of electrical meters.

Frequently, watch repairmen are proprietors of jewelry stores, where, in addition to doing watch repair work, they do minor jewelry repair, and sell watches, jewelry, silverware, and other items. 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

More than 26,000 watch repairmen were employed in early 1967; about half of this number worked for themselves. The majority of those who were self-employed owned small retail jewelry stores that do repair work on the premises. Others (about 2,000) operated their own trade shops, specializing in repairing watches for jewelry stores. The majority of those who were employed by someone else worked in retail jewelry stores, and the remainder were in trade shops, wholesale establishments, and manufacturing plants that make watches, clocks, other precision timing instruments, or electronic equipment.

A substantial number of trained watch repairmen used their skill in jobs such as instrument maker, repairman, or assembler; laboratory technician; microminiaturization specialist in research, development, and engineering laboratories and in Federal, State, and local government agencies. Some watch repairmen were instructors in vocational schools.

The Nation's 21,000 retail jewelry stores are widely scattered throughout the country. The heaviest concentration of these stores is in large commercial and industrial centers such as New York City, Chicago, or Los Angeles.

### Training, Other Qualifications, and Advancement

Many young people prepare for this trade through courses given in private watch repair schools. Some enter through public vocational high school or post-high school training. Others are trained through formal apprenticeship or other on-the-job training programs.

There generally are no specific educational requirements for entrance into any of the approximately 40

watch repair schools, although most of the students are 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 apart and reassembling various types of watch movements, truing hairsprings, removing and replacing balance staffs, fitting friction jewels, and learning how to use a watchmaker's lathe and watch cleaning machines. Some schools offer courses in the repair of unusual types of timepieces, such as chronographs, calendars, and timers. In most schools, students are required to furnish their own handtools. Training in instrument repair work in the armed services can be helpful for those who wish to become watch repairmen.

Students or watch repairmen interested in employment outside of jewelry stores or trade shops may require some training in related subjects such as basic electronics, instrument repair, or microminiaturization technology. Such training is provided on-the-job in many industries.

Important qualifications for success in this field are mechanical aptitude, finger dexterity, a sensitive touch, good vision (with or without glasses), and patience. For those interested in owning or working in retail stores, salesmanship and a good business sense are required. Such people should also have knowledge of business practices, accounting, and public relations.

A few States—Florida, Iowa, Indiana, Kentucky, Louisiana, Minnesota, North Dakota, Oregon, Michigan, and Wisconsin—require watch repairmen to obtain a license to work at the trade. To obtain a license, they must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair. Watch repairmen in all States, however, can demonstrate their ability by passing

an examination given by the American Watchmakers Institute. The certificate awarded to watch repairmen who pass this examination is widely recognized by employers as an indication of an acceptable standard of skill.

Beginners with sufficient funds—about \$2,500 to \$3,500 is needed to purchase a watch-timing machine and other tools and equipment—may open their own watch repair shops. The usual practice, however, is to work for an experienced watch repairman before starting one's own business. Some owners of watch repair shops gradually extend their services to include the sale of various items of jewelry, and may eventually establish retail jewelry stores. Such stores require a more substantial financial investment.

### Employment Outlook

Employment of watch repairmen is expected to show little or no change during the remainder of the 1960's and throughout the 1970's. However, more than 700 job openings will arise annually, mainly from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The supply of workers with watch repair training, particularly of watch repair school graduates who can do all kinds of repair work quickly and accurately, was inadequate in 1966 and is expected to remain so for several years. The number of workers being trained is likely to continue to be insufficient to meet the anticipated employment needs. Some new job openings for watch repairmen will occur in retail stores and trade shops in small cities where business is expanding, and in newly established shopping centers in the suburbs of large cities. In addition, there will be a continuing demand for well-trained workers to use their watch repair skills in the production of miniaturized devices, especially in industries making scientific instruments and electronic equipment.

Several factors are expected to contribute to the demand for watch repairmen. The number of watches in use will undoubtedly rise as population and family incomes increase. 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 increasing use of more complicated timepieces—chronographs, electronic watches, calendar watches, and self-winding watches—will also help to maintain a large volume of repair work. Increased demand for miniaturized consumer goods, such as transistor radios, television sets, and hearing aids, and the trend in the missile, aircraft, instrument, and computer industries toward smaller and lighter weight components and assemblies, are expected to increase further the demand for individuals with watch repair training to work in establishments manufacturing such equipment. On the other hand, the factors that will tend to increase the demand for watch repairmen will be mostly offset by other factors that will operate to decrease it. Sales of inexpensive watches that cost no more to replace than to repair will probably continue to increase, and competition from persons who are employed in other fields, but who repair watches in their spare time, is expected to continue.

### Earnings and Working Conditions

Earnings of watch repairmen in entry jobs generally ranged from about \$80 to \$125 a week in early 1967, depending on individual ability and place of employment. Beginners employed in retail stores usually earned from \$85 to \$95 for a 40-hour week, and those employed in trade shops earned slightly less. Beginners employed by watch manufacturing establishments generally earned from \$105 to \$125 a week.

Experienced watch repairmen employed in retail stores, trade shops, and watch manufacturing establishments received from \$120 to \$175 for a 40-hour week; supervisors or managers of large retail repair departments earned up to \$225 a week. In addition, watch repairmen in retail stores sometimes receive commissions based on sales of watches and other items in the store. Repairmen in large retail and manufacturing establishments often participate in life and health insurance programs and savings and investment plans. Watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. Earnings of the self-employed depend

on the amount of repair work done and, in the case of watch repairmen who own retail jewelry stores, the volume of sales and working hours.

Watch repairmen frequently work longer than the standard 40-hour week. Those who are self-employed or located in small communities usually work a 48-hour week or as long as necessary. The work involves little physical exertion and is generally performed in comfortable, well-lighted surroundings. This light, sedentary work is frequently recommended to certain handicapped workers.

Some watch repairmen are members of the International Jewelry Workers Union or the America Watch Workers Union (Ind.).

### Where To Go for More Information

Information on training courses, as well as on watch repairing as a career, may be obtained from:

American Watchmakers Institute,  
P.O. Box 11011, Cincinnati, Ohio  
45211.

Information on watch repair job opportunities in retail stores can be obtained from:

Retail Jewelers of America, Inc.,  
1025 Vermont Ave. NW., Washing-  
ton, D.C. 20005.

Further information about work opportunities or training in this trade may be available from local offices of the State employment service.

## PRINTING (GRAPHIC ARTS) OCCUPATIONS

Printing is an art, a leading industry, and one of our chief means of communication. In early 1967, it provided employment for more than 1 million workers in a wide variety of occupations. Although these occupations are found principally in the printing, publishing, and allied industries, they are also found in government agencies and in private firms that do their own printing, such as banks, and insurance companies, and manufacturers of paper products and metal containers. About a third of all printing employees work in printing craft occupations. These craft occupations are described in detail later in this chapter. Other occupations in the printing industries include printing estimator, printing technician, mailer, computer programmer, and computer typist, as well as the usual administrative, clerical, maintenance, and sales occupations found in all industries.

### Nature and Location of the Industry

The printing process is basically a means of transferring ink impressions of words, numerals, symbols, and photographs or other illustrations to paper, metal, or other materials. The most commonly used methods of

printing are letterpress, lithography, gravure, flexography, and screen process printing. Each method has special advantages and requires some special skills.

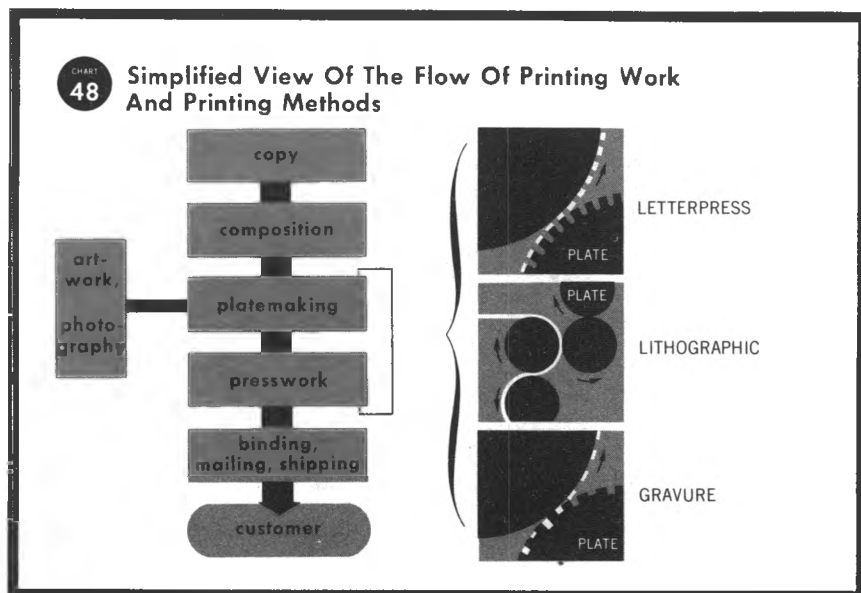
Included in the printing, publishing, and allied industries are the printing and publishing of newspapers, magazines, and books; the production of business forms; the production of greeting cards and gift wrappings; commercial or job printing; bookbinding; and the provision of typesetting, photoengraving, platemaking, and other printing services, primarily for printing establishments.

In early 1967, the largest division in terms of employment was newspaper printing and publishing, with over 360,000 employees in the more than 8,000 establishments. Most daily and many weekly newspapers throughout the Nation do their own printing. Although some major newspapers employ several hundred workers, many smaller dailies and weeklies have fewer than 20 employees.

Commercial or job printing establishments, the second largest division, employed over 325,000 workers in about 19,000 establishments, including lithographic shops. Establishments in this division produce a great variety of materials such as advertising

matter, letterheads, business cards, calendars, catalogs, labels, and pamphlets. They also print limited-run newspapers, books, and magazines. More than half of all workers in commercial shops are in establishments with fewer than 100 workers. A few large plants, that employ a thousand workers or more each, account for about 10 percent of all commercial printing employees.

Printing jobs are found throughout the country. Almost every town has at least one printing shop of some kind—frequently, a small newspaper plant which also may do other 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, most printing activities are in or near manufacturing, commercial, or financial areas such as New York, Chicago, Los Angeles, Philadelphia, San Francisco—Oakland, Cincinnati, and Cleveland. Other leading centers of printing employment are Boston, Detroit, Minneapolis-St. Paul, Washington, D.C., St. Louis, and Baltimore. Employment in book and magazine printing is highly concentrated in these areas. A much larger proportion of employment in newspaper plants,



however, is found outside these centers because of the great number of small local newspapers.

### Printing Methods

All methods of printing have certain common characteristics. A surface of metal, stone, wood, linoleum, rubber, or plastic is so prepared that a part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material which is pressed against the prepared surface.

In relief printing, the printing surface stands up from the rest of the surrounding printing plate area. Ink is rolled over the raised surface and then paper is pressed against it. The best known and most widely used example of this method is letterpress printing; other examples of relief printing are flexography, in which a flexible rubber plate and rapid drying fluid inks are used, linoleum and wood block printing, and relief engraving on metal or plastic.

Flexography is widely used for printing on plastic and foil bags, milk containers, gummed tape, and bread and candy wrappers. In lithography (offset printing), the printing plate surface is smooth, with both image and nonimage areas on the same level. Lithography is based on the principle that grease and water do not mix. The image areas of the plate are coated with a substance to which the greasy printing ink will adhere. On the press, the plate is moistened with water before each inking, so that only the image areas take up the greasy ink from the inking roller. The inked image is transferred or offset from the plate to a rubber blanket and then to the surface to be printed. The lithographic method can be used to produce practically all items printed by any other method. It is especially satisfactory for printing on rough-textured surfaces because of the flexibility of the rubber blanket.

In gravure printing, the material to be printed is etched into the surface of the printing plate. The whole surface is covered with ink and then

wiped off, leaving ink only in the sunken or etched areas. When paper or other material is firmly pressed against the surface, the ink is sucked out and appears on the paper. Copper and steel plate engraving also uses this technique.

Screen process printing is a method in which inks, or other materials such as paint, varnish, and liquid plastic are forced by the action of a flexible blade through a stencil mounted on a finely woven screen, generally silk or stainless steel. The shape of the stencil openings determines the design to be printed. This process may be applied to a wide variety of surfaces such as conventional paper, cardboard, wood, glass, metal, plastic, and textiles. Screen printing is used on irregular surfaces and cylindrical surfaces as well as on flat surfaces. Integrated printed circuits are produced by screen process printing.

Regardless of the method used, several basic steps are involved in the production of printed matter. (See chart 30.) They include: layout—planning the composition and content of each page; typesetting and composition—producing and assembling the text type, headings, illustrations and other materials into final page form; platemaking—preparing printing plates from the original composition for use on the printing presses; printing—transferring an image to a printing surface; and finishing—binding and mailing operations.

### Printing Occupations

Production of printed materials involves workers in a wide variety of occupations. Printing craftsmen who in early 1967 numbered about 365,000 represent a large segment of these employees. Printing craftsmen usually specialize in one area of printing operations; for example, type composition, photography, platemaking, presswork, or binding. Their training, moreover, is largely confined to only one of the basic printing methods—letterpress, lithography, or gravure.

The estimated 173,000 skilled composing room workers employed in early 1967 were the largest group of printing craftsmen. This group includes hand compositors, typesetting machine operators, makeup men, tape-perforating machine operators (teletypesetters), and proofreaders. Other large groups of skilled printing workers are printing pressmen and their assistants; lithographic craftsmen, including cameramen, artists, strippers, platemakers, and lithographic pressmen. Bookbinders, photo-engravers, electrotypers and stereotypers are other important printing craftsmen. Individual occupations are described in detail later in this chapter.

Maintenance machinists, who repair and adjust typesetting machines, printing presses, or bindery equipment, are another group of skilled workers employed in large plants.

In the skilled occupations, practically all the workers are men. However, many of the less skilled jobs, especially in the binderies, are held by women. Printing establishments also employ a great many persons as executives, salesmen, accountants, engineers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters and editors. These occupations are discussed elsewhere in the *Handbook*. (See index for page numbers.)

Because of the increasingly complex and highly mechanized printing equipment in use today, there is a growing need for technically trained people in all areas of printing management and production. For example, an increasing number of production technicians are being employed throughout the printing industry. These men are responsible for seeing that the standards established for each printing job are met. To do this, they must be thoroughly familiar with the printing processes and the many technical instruments used in the plant to judge and control the quality of the printing.

The mailroom, chiefly in newspaper and periodical plants, is an-

other area of employment closely related to printing production. Here workers address, bundle, and tie the printed matter for distribution. Modern mailroom processes are mechanized to a considerable extent. Mailers operate addressing, stamping, stacking, bundling, and typing machines.

### Training and Other Qualifications

Apprenticeship is a common method of entry into the printing crafts. In some instances, it is the only means by which one may be trained to become a journeyman (skilled worker) in a unionized shop. Formal apprenticeship is also required for journeyman status in many larger establishments not covered by union contracts.

At the beginning of 1967, about 12,000 registered apprentices were in training in the skilled printing crafts. A registered apprentice is an employee who, under an expressed or an 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 and Training. In addition, several thousand apprentices were in nonregistered programs. A substantial number of persons were also learning a printing trade while working as helpers, particularly in small printing shops or lettershops, or through a combination of work experience and schooling.

Printing trades apprenticeships usually last from 4 to 6 years, depending on the occupation and the shop or area practices. The apprenticeship program covers all phases of the particular trade and generally includes classroom or correspondence study in related technical subjects in addition to training on the job. As new printing methods have been developed and introduced, they have generally been incorporated into the duties of the traditional printing crafts and included in the apprentice

training programs. Apprenticeship applicants are generally required to be between 18 and 30 years of age and must pass a physical examination. However, in many printing crafts there is no maximum age limit for entry into an apprenticeship.

In selecting applicants for printing craft jobs, most employers require a high school education or its equivalent. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly important because of the growing use of photomechanical and electronic processes in printing. An artistic sense is also an asset since the finished product should be pleasing in balance and design. Most printing crafts require men with good eyesight, about average physical strength, and a high degree of manual dexterity. Mental alertness, speed with accuracy, neatness, patience, and the ability to work with others are also necessary. The ability to distinguish colors is important in areas of printing where color is used. Many employers require applicants to take one or more aptitude tests developed for printing industry occupations by the U.S. Department of Labor. These tests are given in the local offices of State employment services. Apprentices are often chosen from among the young men already employed in various unskilled jobs in printing establishments who demonstrate the mechanical aptitudes essential for the printing crafts.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing. These courses may help a young person to be selected for apprenticeships or other job openings in the printing and publishing industries.

### Employment Outlook

There will be many opportunities to enter the skilled printing trades

through the 1970's. These opportunities will occur primarily as a result of the need to replace experienced workers who retire, die, or transfer to other fields of work. Many of these opportunities, however, will be in new types of jobs because of technological changes in production methods. Retirements and deaths alone may provide 5,000 to 6,000 job openings each year during the decade. Slight employment increases in some printing trades are also expected to provide a small number of additional job openings annually.

A continued rise in the volume of printed material is expected because of population growth, the increasingly high level of education, the expansion of American industry, and the trend toward greater use of printed materials for information, packaging, advertising, and various industrial and commercial purposes. However, employment in skilled printing trades occupations is not expected to increase significantly because of the continuing introduction of labor-saving technological changes in printing methods. These changes, primarily in the areas of type composition, platemaking, and bindery operations, include the increasing use of electronic devices such as computers, electronic etching and color-separating equipment, and electronic controls for highly mechanized bindery equipment.

Employment growth will vary among the printing trades. For example, employment of compositors, the largest group of printing craftsmen, is expected to decrease slightly despite the continued increase in the volume of printing because of labor-saving technological changes in typesetting and composition. Employment of lithographic craftsmen, however, is expected to increase because of the growing use of lithography (offset printing).

### Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry,

including the unskilled and semi-skilled workers and printing craftsmen, are among the highest in manufacturing industries. In 1966, production workers in this industry averaged \$122.61 a week, or \$3.16 an hour, compared with \$111.92 a week, or \$2.71 an hour, for production workers in all manufacturing.

Earnings of individual printing craftsmen vary 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 following tabulation shows the average union minimum hourly wage rates for daywork for selected printing occupations in 69 large cities on July 1, 1966. These rates are the minimum basic rates for the individual occupational classifications. They do not include overtime, other special payments, or bonuses.

	Average union hourly rate, July 1, 1966	
	News-paper <sup>1</sup>	Book and job
Bookbinders.....		\$3.89
Compositors:		
Hand.....	\$4.00	4.05
Machine operators...	4.01	4.06
Electrotypers.....		4.16
Photoengravers.....	4.36	4.65
Pressmen (journeymen)...	3.95	.....
Pressmen (cylinder).....		4.00
Pressmen (platen)....		3.54
Stereotypers.....	3.90	4.27
Mailers.....	3.63	3.43

<sup>1</sup> Average day rates.

A standard workweek of 37½ hours was specified in labor-management contracts covering about 2 out of 5 of the organized printing trades workers, although standard workweeks of 36¼ hours and 35 hours were also in effect. A 40-hour workweek was standard in some establishments in the industry. Time and a half is generally paid for overtime. Work on Sundays and holidays is paid for at time and one-half or double-time rates in most commercial printing establishments. In newspapers plants, however, the craftsmen's workweek often includes Sundays. Time and one-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 are generally 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 civilian or military experience can sometimes obtain credit which will start them above the beginning apprentice pay rate, and also reduce the length of time required to become a journeyman, if they successfully pass examinations provided for situations of this nature. In exceptional cases, these provisions also apply to apprentices with technical school training. In some of the trades, apprentices may be upgraded when they show exceptional progress.

The annual earnings of printing craftsmen depend not only on their hourly rate of pay, but also on how regularly they are employed. The printing industry has fewer seasonal fluctuations than most other manufacturing industries and this is one of the reasons why it offers steadier employment and higher average annual earnings.

Paid vacations are generally provided for printing craftsmen. The most common provision in labor-management agreements is 2 weeks' vacation with pay after 1 year's employment. Many agreements, however, provide for 3 weeks' vacation with pay after 1 year or more of employment, and an increasing number provide for 4 weeks with pay after 20 or 25 years. Other major benefits, such as paid holidays, 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 type or more of benefits, such as life

insurance, retirement, sickness, or disability payments.

The injury-frequency rate in the printing industry is somewhat lower than the average for all manufacturing industries.

A large proportion of the printing trades workers are members of unions affiliated with the AFL-CIO. The largest printing trades unions are the International Printing Pressmen and Assistants' Union of North America, the International Typographical Union, and the Lithographers and Photoengravers Union. Other printing trades unions include the International Brotherhood of Bookbinders, the International Stereotypers' and Electrotypers' Union of North America, and the International Mailers Union (Ind.). The majority of unionized lithographic workers are in plants under contract with the Lithographers and Photoengravers International Union which includes both printing craftsmen and other lithographic workers.

### 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, applicants may apply directly to the joint union-management coordinating committee. In recent years there has been an increasing use of local offices of the State employment services as information exchanges for apprenticeship openings. Some of these offices provide services such as screening applicants and giving aptitude tests. However, the final selection is made by the employer and the joint apprenticeship committee.

General information on the printing industry may be obtained by writing to the following organizations:

American Newspaper Publishers Association,  
750 Third Ave., New York, N.Y.  
10017.

Education Council of The Graphic Arts Industry, Inc.,  
4615 Forbes Ave., Pittsburgh, Pa.  
15213.

Graphic Arts Technical Foundation,  
4615 Forbes Ave., Pittsburgh, Pa.  
15213.

Gravure Technical Institute,  
60 East 42d St., New York, N.Y.  
10020.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Wash-  
ington, D.C. 20015.

(See sections on individual printing occupations for names of labor organizations and trade associations which can provide more information on specific printing trades.)

## COMPOSING ROOM OCCUPATIONS

(D.O.T. 650.582, 654.782, and 973.381)

The printing process begins in a composing room where manuscript copy is set in type, proofed, and checked for errors. Machine and handset type, and other materials, such as photoengravings, are assembled there and prepared for the pressroom.

In early 1967, nearly half of all printing craftsmen—about 173,000 were employed in composing room occupations. These occupations offer many opportunities for persons interested in learning a skilled craft. Compositors usually have year-round employment and very good earnings. Composing room workers include compositors who set type by hand;

typesetting machine operators who operate semiautomatic typesetting machines; tape-perforating machine operators who perforate tapes used to operate some typesetting machines; *bankmen* who assemble type in shallow trays called “galleys” and make trial proofs of this type; *proofreaders* who check the galley proofs with the original copy for errors; *make-up men* who assemble type and photoengravings in page forms; and *stonehands*, who arrange the pages in proper sequence.

Compositors are employed in newspaper plants, commercial printing shops, in book and periodical printing plants, and in typographic composition firms that set type for printing establishments, advertising agencies, and advertising departments of large business firms. A third of all compositors work in newspaper plants. A large number are employed in establishments that specialize in setting type for book and magazine publishers.

Skilled composing room workers are employed in almost every community throughout the country, but they are concentrated in large metropolitan areas such as New York, Chicago, Los Angeles, Philadelphia, Boston, San Francisco, Detroit, Minneapolis—St. Paul, Cleveland, and Washington, D.C.

### Nature of Work

*Hand compositors (typesetters)* (D.O.T. 973.381) make up the oldest composing room occupation. The majority of type that is set by hand today is for work requiring very fine composition, usually larger size type being used for advertising copy, and for small jobs where it would be impractical to set the type by machine.

In setting type by hand, the compositor, reading from the manuscript copy, first 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 shallow metal tray called a “galley.”

*Typesetting machine operators* are craftsmen who operate semiautomatic machines which set type much more rapidly than the hand compositors. The type size used in machine set composition ordinarily is much smaller than that set by hand.

*Linotype (or Intertype) machine operators* (D.O.T. 650.582) reading from the copy clipped to the machine's copy board, select letters and other characters by operating a keyboard which has 90 keys. As they press the keys, the letters, in forms of metal molds called matrices, are assembled into lines of words. A spaceband key provides the necessary spacing between words. As they complete each line, the operators touch a lever and the machine automatically casts the line of type into a solid metal strip called a “slug.” The slugs are then deposited in a galley and are later assembled into the type forms from which either the printing impressions or the plates are made. Nearly all newspaper plants, large commercial shops, and typographic composition firms use these machines and operators to set type. In the smaller plants, the typesetting machine operator maintains and repairs as well as operates the typesetting machine. In the larger plants, maintenance machinists are employed to make all but minor adjustments to the machines.

Other typesetting machine operators work on Monotype machines. One machine is called the Monotype keyboard and the other is the Monotype caster.

*Monotype keyboard operators* (D.O.T. 650.582) operate keyboards quite similar to those on a typewriter, but which include about four times as many keys. The keyboard machine produces a perforated paper tape which is later fed into the casting machine. The keyboard operator must be able to handle complicated copy, such as statistical tables.

*Monotype caster operators* (D.O.T. 654.782) operate the casting machines which automatically cast and assemble the type, guided by the perforations in the paper tape



prepared by the keyboard machine. As the rolls of perforated tape are fed into the machines, the proper matrices for casting letters are automatically selected by means of the perforations in the tape. Molten metal is forced into the matrix to form the individual character. The Monotype casting machine, as the name suggests, casts type one letter or character at a time. This permits some corrections to be made by hand without the need to reset an entire line. The principal duties of caster operators are to insert the tape, adjust and tend the machine while it is operating, and do necessary maintenance and repair work. Only one caster operator is employed to every two or three keyboard operators. Typographic composition firms are the largest employers of both Monotype keyboard and caster operators.

*Phototypesetting machine operators* (D.O.T. 650.582) set type on machines which may be similar in appearance, or method of operation, or both, to those which cast type in hot metal. In phototypesetting, however, a photographic process replaces the function of the hot metal, and the final product is a film or photographic paper print of the type rather than a metal slug. In one type of machine, as the operator presses the keys, the individual matrices or mats, which contain small film negatives, are assembled and photographed on film, character by character, to form a line of type. In other phototypesetting machines, a perforated paper tape, or a magnetic sound tape is fed into a phototypesetting machine which "reads" the tape and photographs the individual characters indicated on the tape.

Some typesetters operate photolettering machines which produce lines or individual characters in large-size type such as that used for newspaper headlines and for advertisements. As in phototypesetting, a photographic process is involved, and the final product is on film or paper.

In addition to machine operation, the phototypesetter must be familiar

with the fundamentals of photography, including darkroom procedures, because frequently he has to develop the film on which the type has been photographed. He may also assemble and arrange developed film into pages. This process, called "stripping," corresponds to page makeup in the hot metal type process. The operator also makes minor repairs on the phototypesetting machine. Since much of this equipment has electronic controls, the operator needs a basic working knowledge of the principles of electronics.

Typesetting machine operators also set type by the "cold type" method. The type is set on paper, using machines that are similar to typewriters. These machines automatically space letters and lines. "Cold type" composition may be set directly on a paper or even a metal sheet from which the plate is to be made, or the cold type images may be cut from paper and pasted on layout sheets. The process of assembling and pasting this type on layout sheets is called paste makeup, and is somewhat similar to hand composition. The worker who assembles and pastes up all the materials for a page is called a paste-make-up man. Cold type composition is frequently used by newspapers for display advertising, and by small newspapers to set regular text copy.

Typesetters frequently operate tape-perforating machines called teletypesetters. These are machines with keyboards similar to those of typewriters. The machines are fitted with reels of tape that are perforated as the keys are struck. The perforated tapes are inserted in line casting machines, which set the type as directed by the perforations. After the tape has been punched, it may be sent by teletype to other cities where it is automatically re-perforated and used to control the operation of linecasting machines.

### Training and Other Qualifications

Most compositors acquire their skills through apprenticeship training. In union shops, apprentices are



**Typesetter prepares automatic linecasting machine tape for hyphenation and justification by computer.**

often selected from among the helpers. Some compositors acquire 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.

Tape-perforating machine operators must be expert typists. They generally acquire their typing skill in commercial courses in high school or in business school. It is not necessary for these operators to be trained as journeymen compositors to perform their work efficiently; however, they must be familiar with printing terms and measurements. The training period for tape-perforating machine operators is generally about a year. Journeymen compositors sometimes transfer to this occupation.

Generally, apprenticeship 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 to 2½ years for apprentices who have had previous experience or schooling or who show the ability to learn the trade more rapidly. The time and em-

phasis 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 instruction in elementary hand composition, page makeup, lockup, lineup, and proof-reading. After basic training as a hand compositor, the apprentice receives intensive training in one specialized field or more, such as the operation of typesetting machines, including phototypesetting and teletypesetting machines, as well as specialized work in hand composition and photocomposition.

Applicants for apprenticeship generally must be high school graduates and in good physical condition. They are sometimes given aptitude tests. Important qualifications include training in English, especially spelling, and in mathematics. Printing and typing courses in vocational or high schools are good preparation for apprenticeship applicants, and a general interest in electronics and photography is becoming increasingly useful. Artistic ability is an asset for a compositor in layout work.

Apprentices are paid according to a predetermined wage scale, which increases as the apprenticeship period advances. At the beginning of 1967, there were about 4,600 registered apprentices in training for skilled composing room jobs.

### Employment Outlook

A few thousand job openings for composing room workers are expected annually through the 1970's because of the need to replace experienced workers who retire or die. Retirement and deaths alone should provide approximately 3,000 job openings annually.

In spite of the anticipated expansion in the volume of printing in the United States during the decade, employment of compositors is expected to decline slowly because of technological changes in typesetting equipment that will make it possible to set

type faster and with fewer operators. For example, over the past decade there has been an increasing use of automatically operated typesetting machines. These machines, which set lines of type in metal or on film, are activated by an electronic device into which perforated tapes are fed. The perforations indicate characters, words, sentences, length of lines, spacing, and hyphenation. The recent introduction of computers, programmed to perforate the codes for spacing, length of line, and hyphenation, simplifies the work of the tape-perforating machine operator, and increases the speed at which type can be set.

Technological changes also will significantly affect the educational and skill requirements for composing room workers. The greater use of phototypesetting, for example, requires compositors to have some photographic skills. Since much of the new typesetting equipment is operated by electronic systems, a knowledge of the application of electronic principles to the operation of this equipment is becoming increasingly important for the compositor.

### 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. The average union minimum hourly wage rate for hand compositors on day shift in 69 large cities was \$4.00 in newspaper plants and \$4.05 in book and job shops on July 1, 1966. Union minimum wage rates for compositors in book and job shops ranged from \$2.80 an hour in Jackson, Miss., to \$4.50 in Fresno, Calif. In newspaper establishments, the union minimum hourly wage rates for day-shift compositors ranged from \$3.40 an hour in Knoxville, Tenn., to \$4.91 in Chicago.

Working conditions for compositors vary from plant to plant. Some heat

and noise are made by hot metal typesetting machines. In general, the newer plants are well lighted and clean, and many are air conditioned. Composing room jobs require about average physical strength. Hand compositors are required to stand for long periods of time, and to do some lifting. Young men with some types of physical handicaps, such as deafness, have been able to enter the trade and do the work satisfactorily. Many compositors work at night on the second or third shift for which they generally receive additional pay.

A substantial proportion of compositors are members of the International Typographical Union.

### Where To Go for More Information

International Typographical Union,  
P.O. Box 157, Colorado Springs,  
Colo. 80901.

International Typographic Composition Association, Inc.,  
2233 Wisconsin Ave. NW., Wash-  
ington, D.C. 20007.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Wash-  
ington, D.C. 20015.

See page 448 for additional sources of information.

### PHOTOENGRAVERS

(D.O.T. 971.381 and .382)

### Nature of Work

*Photoengravers* make metal printing plates of illustrations and other copy that cannot be set up in type. The printing surfaces on these plates stand out in relief above the non-printing spaces, as do the letters and the accompanying type. Similarly, gravure photoengravers, a specialized type of photoengraver, make gravure plates in which the image is etched

below the surface for use in reproducing pictures and type.

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. Specialists include cameramen, printers, etchers, finishers, routers, blockers, and proofers. 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. Plates made from line drawings are called line plates and those from photographs are called halftone plates. 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 non-image areas are etched away, leaving the image areas standing out in relief.

A number of other photoengraving operations may be performed depending on the quality of the printing required. Photoengravings for very high quality books or periodicals, for example, require more careful finishing than those for newspapers. 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 *proof-er* prints a sample copy on a proof press.

The operations involved in gravure photoengraving are much like those in letterpress photoengraving except that the image areas, rather than the background, are etched away.

### Where Employed

About 17,000 journeymen photoengravers were employed in early 1967. 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 several thousand photoengravers. In addition, book and periodical shops and the U.S. Government Printing Office also employ photoengravers. Many of these 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, Pennsylvania, Illinois, and Kentucky.

### Training, and Other Qualifications

The most common way to become a photoengraver is through apprenticeship training. At the beginning of 1967, there were over 500 registered apprentices in training for skilled photoengraving occupations. The apprenticeship program generally covers a 5- or 6-year period and in-



Photoengraver cuts away metal from nonprinting areas of printing plate.

cludes 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.

Apprenticeship applicants must be at least 18 years of age and generally must have a high school education or its equivalent, preferably with 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

A few hundred job openings are expected each year through the 1970's because of the need to replace photoengravers who retire or die. However, no increase in the total number of these craftsmen is anticipated during the remainder of the 1960's and over the next decade despite the growing use of photographs and other illustrations, and the increasing use of color. The introduction of more rapid etching techniques, the application of electronics to engraving and to color separation, and the increasing use of offset printing, which requires no photoengravings, will limit the number of photoengravers needed.

### Earnings and Working Conditions

Photoengravers are among the highest paid printing craftsmen. The average union minimum hourly wage rate for photoengravers in 69 large cities was \$4.36 in book and job shops and \$4.65 for the day shift in newspaper plants. Union average minimum hourly rates ranged from \$3.27

an hour in New Orleans, La., to \$5.27 an hour in New York.

The great majority of photoengravers are union members. Nearly all unionized photoengravers are represented by the Lithographers and Photoengravers International Union.

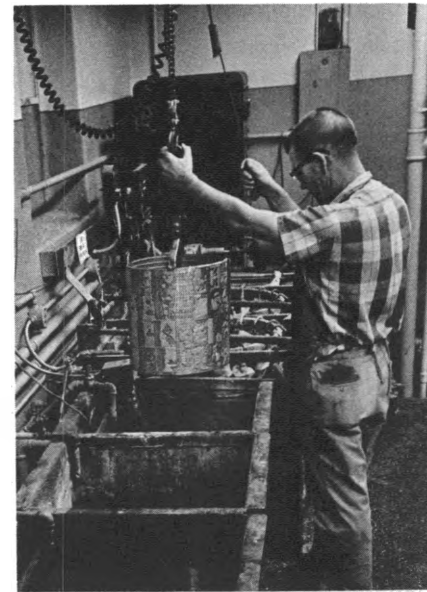
### Where To Go for More Information

American Photoengravers Association,  
166 West Van Buren St., Chicago,  
Ill. 60604.

Lithographers and Photoengravers  
International Union.  
233 West 49th St., New York, N.Y.  
10019.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Wash-  
ington, D.C. 20015.

See page 448 for additional sources of information.



Stereotyper uses electrolytic plating equipment to give proper finish to plate for color printing.

## ELECTROTYPERS AND STEREOTYPERS

(D.O.T. 974.381 and 975.782)

### Nature of Work

*Electrotypers* (D.O.T. 974.381) and *stereotypers* (D.O.T. 975.782) make duplicate press plates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly 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, magazine, or newspaper is printed, several plates must be used to replace those which become too worn to make clear impressions. Also, by means of duplicate plates, printers can use several presses 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 either electrotyping or stereotyping processes from the flat type forms.

Several steps are required to produce a duplicate, curved 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; this shell is then stripped from the mold, backed with metal or plastic, 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 paper-mache (a strong material composed of paper pulp) instead of wax or plastic. This involves placing the mat on the type form, and covering it with a cork blanket and sheet of fiberboard. The covered form is run under

heavy power-driven steel rollers to impress the type and photoengravings on the mat. Then the mat is placed in a stereotype casting machine which casts a composition lead plate on the mold. In many of the larger plants, stereotype plates are cast in automatic machines.

In many of the larger plants, electrotypers and stereotypers perform only one phase of the work, such as casting, molding, finishing, or blocking. However, journeymen must know how to handle all the tasks involved in their respective trades.

Many electrotypers work in large plants that print books and periodicals. The majority of stereotypers work in newspaper plants, but some are employed in large commercial printing plants. Electrotypers and stereotypers are also employed in independent service shops which do this work for printing firms.

### Training and Other Qualifications

Nearly all electrotypers and stereotypers learn their trades through apprenticeship. Electrotyping and stereotyping are separate crafts, and there is little transferability between the two. The apprenticeship program in each trade covers all phases of the work 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.

Apprenticeship applicants 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.

### Employment Outlook

There will be some opportunities for new workers to become electrotypers and stereotypers through the 1970's because of retirements, deaths, or transfers of workers to other occupations. However, the total number of electrotypers and stereotypers, is expected to continue to decline moderately.

This decline will occur in spite of the anticipated increase in the total volume of printing, because of technological changes. For example, the increasing use of automatic plate casting eliminates many steps in platemaking, and plastic and rubber plates are increasingly being made outside electrotyping and stereotyping shops. Furthermore, the increasing use of offset printing reduces the need for electrotypers and stereotypers, since this type of plate is not required in offset printing.

### Earnings and Working Conditions

On July 1, 1966, the union minimum hourly wage rates in 69 large cities averaged \$4.16 an hour for electrotypers, \$4.27 an hour for stereotypers in book and job shops, and \$3.90 an hour for stereotypers on day shift in newspaper plants. Union minimum hourly wage rates for electrotypers in book and job plants ranged from \$3.44 an hour in Richmond, Va., to \$4.67 an hour in New York. In newspaper plants, rates for day-shift stereotypers ranged from \$3.23 an hour in Springfield, Mass., to \$5.89 an hour in Chicago.

Much of the work requires little 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, 10 South La Salle St., Chicago, Ill. 60603.

International Association of Electrotypers and Stereotypers, Inc., 758 Leader Building, Cleveland, Ohio 44114.

Printing Industries of America, Inc., 20 Chevy Chase Circle NW., Washington, D.C. 20015.

See page 448 for additional sources of information.

### PRINTING PRESSMEN AND ASSISTANTS

(D.O.T. 651.782, .885, and .886)

#### Nature of Work

The actual printing operation is performed in the pressroom. Printing pressmen "makeready" (prepare) type forms and press plates for final printing and tend the presses while they are in operation.

The object of 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 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, pressmen have assistants and helpers.

Pressmen's work may differ greatly from one shop to another, mainly be-



Pressman adjusts stereotype plate on newspaper press.

### Training and Other Qualifications

As in other printing crafts, the most common way of learning the pressman's trade is through apprenticeship. Some workers have been able to learn the skills of 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 in commercial shops is 2 years for press assistants and 4 years for pressmen. In newspaper establishments the apprenticeship period is 5 years. The apprenticeship period for pressmen operating web presses is generally 5 years. 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 involves related classroom or correspondence schoolwork. At the beginning of 1967, about 3,500 registered apprentices were in training.

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. Because of technical developments in the printing industry, a year of chemistry and a year of physics should be included. Mechanical aptitude is important in making press adjustments and repairs. An ability to visualize color is essential for work on color presses, which are used increasingly. 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.

cause of differences in the kinds and sizes of presses used. Small commercial shops generally have small and relatively simple presses that are often fed paper by hand. At the other extreme are the enormous web-rotary presses used by the larger newspaper, magazine, and book printing plants. These giant presses are fed paper in big rolls called "webs," up to 50 inches or more in width. They print the paper on both sides by means of a series of cylinders; cut, assemble, and fold the pages; and, finally, count the finished newspaper sections which emerge from the press ready for mailing. 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 *lithographic (offset) pressmen* are similar to those of letterpress and gravure pressmen, a number of differences exist, principally because of the specialized character of lithographic presses. (See p. 455 for further details.)

The duties of *press assistants* range from feeding sheets of paper into hand-fed presses to helping pressmen makeready and operate large and complicated rotary presses. Workers whose main responsibility is feeding are often called *press feeders*. The ratio of assistants to pressmen differs 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 pressroom assistants.

### Employment Outlook

Employment of pressmen is expected to increase moderately throughout the 1970's. The total amount of printing and the use of color are expected to increase, requiring larger and more complex presses. However, continued improvements in the speed and efficiency of printing presses will limit the need for additional pressmen.

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 may result in about 1,500 job openings each year.

### 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. A survey of union minimum hourly wage rates for daywork in 69 large cities shows that the average minimum hourly rate in effect on July 1, 1966, for newspaper pressmen-in-charge was \$4.30; for newspaper pressmen (journeymen), \$3.95; for book and job cylinder pressmen, \$4.00; for book and job platen pressmen, \$3.54; and for book and job press assistants and feeders, \$3.34.

Pressrooms are unavoidably noisy—one State, California, now requires newspaper pressmen working in certain areas of the pressroom to wear ear protectors. There are also 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 the rate of pay is higher than the basic day rate.

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,  
Pressman's Home, Tenn. 37850.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Wash-  
ington, D.C. 20015.

See page 448 for additional sources of information.

## LITHOGRAPHIC OCCUPATIONS

(D.O.T. 972.)

### Nature of Work

Lithography (offset printing) is one of the most rapidly growing methods of printing. Practically all items printed by other processes are also produced by lithography—including books, calendars, maps, posters, labels, office forms, catalogs, folding cartons, and newspapers. Lithography has special advantages when the copy to be reproduced includes photographs, drawings, or paintings, since the rubber blanket which transfers the image from the plate to the surface to be printed permits greater flexibility in the type of paper that can be used.

Several operations are 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.

The *cameraman* (D.O.T. 972.382) starts the process of making a lithographic plate by photographing the copy. He is generally classified as a line cameraman (black and white), halftone cameraman (black and

white), or color separation photographer.

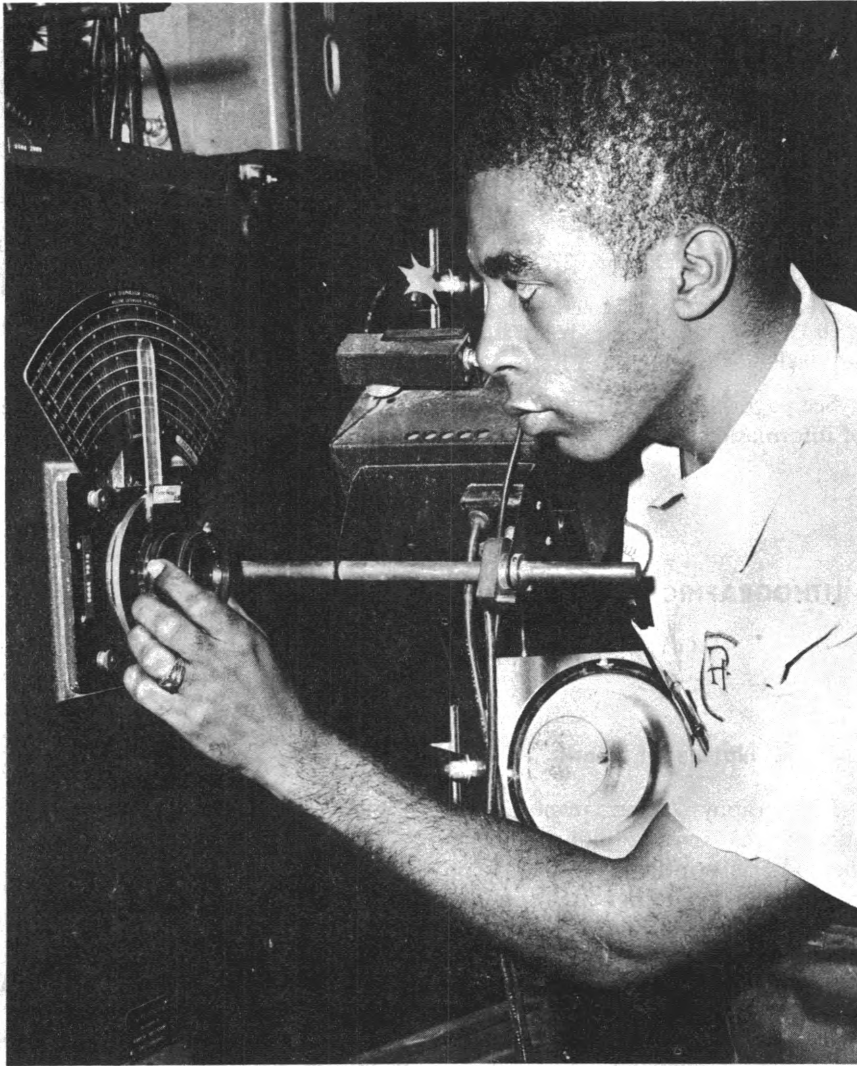
After the negatives have been made, they frequently need retouching to lighten or darken certain parts. Thus, it is often necessary for a *lithographic artist* (D.O.T. 972.281) to make corrections by sharpening or reshaping images on the negatives. Highly skilled workers perform this work by hand, using chemicals, dyes, and special tools.

To qualify as journeymen, these artists must be adept in one of the various retouching methods or more. Like cameramen, they are customarily assigned to only one phase of the work and may then be known, for example, as dot etchers, retouchers, or letterers, depending on their particular job.

The *stripper* (D.O.T. 971.381) makes layouts on paper, glass, or film. He arranges and pastes film or prints of type, pictures, and other art work on the layout sheets called flats or "stripups," from which photographic impressions are made for the lithographic press plates. The job of the stripper in the lithographic process corresponds to that of the makeup man in the letterpress process.

In lithography, employees in the platemaking department expose press plates to photographic films which are made by the cameramen and corrected by artists. The *platemaker* (D.O.T. 972.781) may cover the surface of the metal plate with a coating of photosensitive chemicals, or the metal plate may come to him with the photosensitive layer applied. The platemaker exposes the sensitized plate through the negative or positive to strong arc lights; this is commonly done in a vacuum printing frame. When a large number of the same images are to be exposed on a single plate, however, the operation is done in a photocomposing machine. The plate is then developed and chemically treated to bring out the image.

The *lithographic pressman* (D.O.T. 651.782) makes ready and tends the lithographic (offset) printing presses. He installs the plate on the press, adjusts the pressure for proper printing,



**Cameraman adjusts lens before making printing plate.**

cares for and adjusts the rubber blanket which takes the impression from the plate and transfers it 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. Some differences exist, however, because of the chemical means used to separate image and nonimage areas on lithographic presses. In large plants, press feeders and helpers are employed; their duties are similar to those of assistant and helpers to letterpress and gravure pressmen. (See p. 454.)

### **Training and Other Qualifications**

A 4- or 5-year apprenticeship covering the basic lithographic process is usually required to become a well-rounded lithographic craftsman. Training emphasis is on the specific occupation in which journeyman status is being sought, although generally, an attempt is made to make the apprentice familiar with all lithographic operations. At the beginning of 1967, there were about 1,700 registered apprentices in training for skilled lithographic occupations.

Usually, apprenticeship applicants must be in good physical condition,

high school graduates, and at least 18 years of age. Aptitude tests are sometimes given to prospective apprentices. Vocational school training, and training in photography, mathematics, chemistry, physics, and art are helpful in learning these crafts.

### **Employment Outlook**

A moderate rise in the number of lithographic workers is expected through the 1970's. In addition, the need to replace workers who retire, die, or transfer to other fields of work will provide some job openings. Employment growth and replacement needs together are expected to provide about 2,000 jobs opportunities for new workers, on the average, each year during the 1960's and over the remainder of the next decade.

Offset printing has expanded considerably in recent years, particularly in the commercial printing field, and a large number of letterpress concerns have established offset departments. Offset presses are used increasingly in smaller newspaper establishments. In 1967, an estimated 61,000 journeymen lithographic workers were employed. Offset printing employment should show continued 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, particularly in the camera, platemaking, and press departments, are expected to slow the increase in lithographic employment.

### **Earnings and Working Conditions**

Union minimum hourly wage rates for lithographic occupations vary within each occupation, depending upon the degree of skill required, the type and size of equipment, and the part of the country in which the worker is employed. For example, ac-





Stripper combines type and picture negative in "strip-up."

cording to information on union minimum hourly wage rates in 69 large cities as of July 1, 1966, wage rates for dot etchers or process artists and letterers ranged from \$3.12 an hour in Little Rock, Ark., to \$5.08 an hour in Los Angeles and San Diego, Calif. Rates for cameramen, which are generally below those for skilled artists, ranged from \$2.60 an hour in San Antonio, Tex., to \$5.28 an hour in San Francisco and Oakland, Calif.

In many plants, top grade cameramen earn as much as the highly skilled artists, and cameramen who do multicolor work are paid more than those who do only black and white work. Minimum hourly rates of platemakers ranged from \$2.25 an hour in San Antonio to \$5.01 an hour in Los Angeles and San Diego. The wide range of rates for lithographic pressmen—from \$2.33 an hour for small multilith press operators in Lit-

tle Rock to \$6.85 an hour for first pressmen on a large eight-plate rolled offset press in Chicago—is due largely to the many different types and sizes of presses operated.

A substantial proportion of all lithographic workers are members of the Lithographers and Photoengravers International Union. A considerable number of offset pressmen and other offset workers are members of the International Printing Pressmen and Assistants' Union of North America.

### Where To Go for More Information

Lithographers and Photoengravers International Union,  
233 West 49th St., New York, N.Y. 10019.

International Printing Pressmen and Assistants' Union of North America,  
Pressmen's Home, Tenn. 37850.

Graphic Arts Technical Foundation,  
4615 Forbes Ave., Pittsburgh, Pa. 15213.

National Association of Photo-Lithographers,  
230 West 41st St., New York, N.Y. 10036.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Washington, D.C. 20015.

See page 448 for additional sources of information.

### BOOKBINDERS AND RELATED WORKERS

(D.O.T. 977.781)

#### Nature of Work

Many printed items such as books, magazines, pamphlets, business forms, and calendars must be folded, sewed, stapled, or bound after they leave the printing shops. Much of

this work is done by skilled *bookbinders* (D.O.T. 977.781) who numbered about 24,000 in early 1967. 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 and of 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. Blankbook and looseleaf binderies bind various types of blank books such as ledgers and bookkeeping and accounting volumes. They also produce loose leaf binders, and bind books in looseleaf form.

Edition binding—making books in quantity from big, flat printed sheets of paper—is by far the most complicated. The first step in the process is to fold the printed sheets into one unit or more, 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 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 may 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 workers trained in only one operation



Bookbinder marbles book edges.

or in small number of relatively simple, related tasks. Most of these workers, often classified as bindery workers or bindery hands, are women (hence the common designation, bindery women). Their work closely resembles assembly line factory work. About 45,000 women and men were employed in these operations in early 1967.

### 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. When large quantities of books are bound on a mass production (edition) basis, emphasis is on the most modern machine methods. In fine hand binding, emphasis is mainly on hand methods, including artistic designing and decorating of leather covers. For many years, hand bookbinding has been declining in importance.

Apprenticeship applicants usually must have a high school education and be at least 18 years of age. Me-

chanical 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 such as 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

A few hundred job openings for skilled bookbinders are expected each year during the remainder of the 1960's and over the next decade because of the need to replace experienced workers who retire or die. Many openings are expected for bindery hands, the majority of whom are women, because of the considerable turnover among this group. However, some decrease in the total number of bookbinders and bindery hands is expected, despite the anticipated growth in the amount of bound printed materials, because of the increasing mechanization of bindery operations.

### Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average of other printing crafts. A survey of union minimum hourly wage rates in 69 large cities, as of July 1, 1966, showed that the minimum hourly wage rate for bookbinders in book and job establishments averaged \$3.64 an hour and rates ranged from \$4.53 in the San Francisco area to \$3.00 in Shreveport, La. The wage rates for bindery women are considerably lower and are among the lowest for printing industry workers. They ranged from \$1.68 an hour in Little Rock to \$3.04 in the San Francisco area.

The majority of bindery workers are union members. Most skilled bookbinders are represented by the International Brotherhood of Bookbinders.

**Where To Go for More Information**

International Brotherhood of Bookbinders,  
1612 K St. NW., Washington, D.C.  
20016.

Printing Industries of America, Inc.,  
20 Chevy Chase Circle NW., Wash-  
ington, D.C. 20015.

See page 448 for additional sources  
of information.

## SOME OTHER MANUAL OCCUPATIONS

### ASSEMBLERS

#### Nature of Work

Many of the products and parts made in factories must be assembled during various steps in the manufacturing process as well as in the final assembly of the product. For example, television sets, automobiles, and refrigerators are typical of the products which undergo many assembly operations. The workers who put together parts or finished products, nearly all of whom are semiskilled workers, are known as assemblers.

Some assemblers, known as floor assemblers, put together large, heavy machinery or equipment on shop floors, often fastening parts with bolts, screws, or rivets. Others, known as bench assemblers, put together small parts to make subassemblies or small complete units while working at a bench. Many assemblers work on products or parts which move automatically past their work stations on conveyors. These workers must do their assembly job within the time period it takes the part or product to pass their work station.

The job duties of assemblers depend upon the product being manufactured, and the manufacturing process being used. In aircraft and missile production, these workers may

assemble and install parts into subassemblies. In the automobile industry, one assembler may start nuts on bolts, and the next worker on the assembly line tightens the nuts with power-driven tools. Assemblers in electronic plants may connect parts with electrical wire.

The kinds of tools semiskilled assemblers use depend upon the job they are doing and the product on which they are working. Pliers, screwdrivers, soldering irons, power drills, and wrenches are among the common tools used by semiskilled assemblers.

(In contrast with the semiskilled assemblers described in this statement, skilled assemblers work on the more complex parts of subassemblies with little or no supervision and are responsible for the final assembly of complex jobs. These skilled workers must know how to read blueprints and other engineering specifications and use a variety of tools and precision measuring instruments. In relatively new fields such as electronics, instrumentation, and missiles, subassembly work may require a high degree of skill.)

#### Where Employed

Assemblers work in plants that mass-produce products such as automobiles, aircraft, television sets, cameras, refrigerators, watches, and electrical motors. In early 1967, approximately 750,000 assemblers (most of whom were semiskilled) were employed in manufacturing plants, with the great majority in electrical machinery and other metalworking plants. The majority of semiskilled assemblers were employed in California, New York, Michigan, Illinois, Ohio, Indiana, and Pennsylvania.

About half of all semiskilled assemblers were women, who worked primarily as bench assemblers. The largest proportion of women assemblers worked in the electrical machinery, equipment, and supply industry.

Large numbers of women assemblers also were employed in other industries—fabricated metals; machinery, except electrical; transportation equipment; and instruments and related products.

#### Training, Other Qualifications, and Advancement

Inexperienced workers who are hired to do semiskilled assembly work are usually trained on the job in a few days or weeks. The new worker may have his job duties explained to him by his supervisor and then be placed under the supervision of an experienced employee. The trainee observes the experienced employee at work or directly assists him in his work. When the learner develops sufficient speed, he is placed "on his own" and is responsible for the work he produces.

Employers generally want applicants for semiskilled assembly jobs to be physically able, dependable and have some aptitude for mechanical work.

High school graduates or workers who have taken vocational school courses, such as blueprint reading, are preferred by many employers although a high school diploma is not usually required. Generally, for production-line assembly jobs, employers look for applicants who can do routine work at a steady and fast pace. For other types of assembly jobs, applicants may have to meet special requirements. For example, in plants producing electrical and electronic products, which may contain many different colored wires, applicants often are tested for color blindness.

Many women are employed in semiskilled bench assembly jobs because such work is relatively light and often requires the ability to work with small and delicate objects. This is particularly true in the electrical and electronic equipment industry. Male workers are usually employed as floor or line assemblers, where the work is physically hard. Final automobile as-



**Many women are employed as electronic components assemblers.**

sembly, for example, is generally done by men.

A relatively small number of workers who learn to perform a variety of assembly work and who have a knowledge of blueprint reading and shop mathematics are able to become skilled assemblers. A few workers also may become skilled inspectors or foremen.

### Employment Outlook

Many thousands of openings for semiskilled assemblers are expected during the remainder of the 1960's and through the 1970's. Several thousand job openings are expected to result annually from a slow increase in employment over this period. Most job opportunities in this large occupation group, however, will result from the need to replace workers who retire, die, or transfer to other fields of work, and to replace women who leave their jobs to marry or rear a family. Deaths and retirements alone will account for about 20,000 openings each year.

Most of the industries that employ assemblers, especially the electrical machinery industry, are expected to increase their employment during this period; however, technological changes are expected to hold down the growth of this occupation. For example, the introduction of printed electrical circuits reduces the wiring work required in assembling radio and television sets, thus affecting the employment of assembly workers in plants producing these products. Further increases in the use of automatic assembly processes are expected to continue to slow the growth of assemblers.

Employment in metalworking manufacturing plants, which have many assemblers, is particularly sensitive to changes in business activities and national defense needs. Therefore, assemblers in those industries will continue to be subject to occasional layoffs.

### Earnings and Working Conditions

Earnings of semiskilled assemblers in manufacturing industries vary widely, depending on their skill, the type of product assembled, and factors such as the size and location of the plant in which they are employed.

Assembly jobs are commonly classified as A, B, and C, to reflect the level of skill and responsibility involved. (For the purpose of this publication, class B and C assemblers are considered to be semiskilled workers.)

The following table presents average straight-time hourly earnings of class B and C assemblers in the nonelectrical machinery industry:

*Average straight-time hourly earnings of class B and C assemblers in nonelectrical machinery, mid-1966*

Area	Class B	Class C
United States <sup>1</sup> . . . . .	\$2. 68	\$2. 32
New England . . . . .	2. 60	2. 34
Middle Atlantic . . . . .	2. 60	2. 17
Border States . . . . .	2. 64	2. 23
Southeast . . . . .	1. 95	1. 79
Southwest . . . . .	2. 16	1. 84
Great Lakes . . . . .	2. 87	2. 45
Middle West . . . . .	2. 71	2. 47
Pacific . . . . .	2. 60	2. 23

<sup>1</sup> Includes data for Mountain States.

The working conditions of semiskilled assemblers differ, depending on the particular job performed. Assemblers of electronic equipment may put together small components at a bench in a room which is clean, well lighted, and free from dust. Floor assemblers of industrial machinery, on the other hand, may install and assemble heavy parts and are often exposed to contact with oil and grease. Assemblers on assembly lines may be under pressure to perform their assignments in the time the conveyor moves the parts or subassemblies past their work stations. Assemblers paid incentive or piecework rates are encouraged to work more rapidly by the prospect of higher earnings.

Many semiskilled assemblers in manufacturing industries are members of labor unions. These unions include the International Association of Machinists and Aerospace Workers; the International Union of Elec-

trical, Radio and Machine Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers. Most labor-management contracts in the manufacturing plants in which assemblers are employed provide for fringe benefits, such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

### AUTOMOBILE PAINTERS

(D.O.T. 845.781)

#### Nature of Work

The automobile painter's job is to make old or damaged motor vehicles "look like new." These skilled workers repaint vehicles that have lost the luster of their original paint, and the repaired portions of vehicles damaged in traffic accidents. (Production painters who work for motor vehicle manufacturers are discussed elsewhere in the *Handbook*.)

In preparing an automobile for painting, the painter or his helper rough sands or removes the original paint. The painter then applies primer coats to the automobile surface with a spray gun and, after the primer dries, sands the surface by hand with a fine grade of sandpaper until it is smooth enough to be painted. For rough sanding, he usually uses a pneumatic or electric sander and a coarse grade of sandpaper. If small nicks and scratches in the surface cannot be removed by sanding, he fills them with automobile-body putty. He uses masking tape and paper to cover areas not to be painted.

Before painting repaired portions of an automobile, the painter may have to mix paints in order to match the existing color of the automobile. Before applying the paint, he adjusts the nozzle of the spray gun according to the kind of lacquer or enamel being



Painter covers chrome with masking tape before painting automobile.

### Training, Other Qualifications, and Advancement

Most automobile painters start as helpers and acquire their skills informally by working for several years with experienced painters. Usually, the beginner's work consists of tasks such as removing automobile trim, cleaning and sanding surfaces to be painted, and polishing painted surfaces. As helpers gain experience, they progress to more complicated tasks such as using spray guns to apply primer coats and paint small areas. It usually takes 3 to 4 years of informal on-the-job training to become a fully qualified automobile painter.

A small number of automobile painters learn their trade through apprenticeship. Apprenticeship programs for automobile painters, which generally last 3 years, consist of on-the-job training supplemented by related classroom instruction.

Young men considering this work as a career should have good health, keen eyesight, a discerning color sense, and a steady hand. Courses in automobile-body repair, which are offered by a relatively small number of high schools and vocational schools, provide helpful experience. Although a high school education is generally not a requirement for getting a job as a painter's helper, it is an advantage because many employers believe it indicates that a young man can "complete a job."

An experienced automobile painter with supervisory ability may advance to shop foreman. Many experienced painters who acquire the necessary capital eventually open their own shops.

### Employment Outlook

Employment of automobile painters is expected to increase moderately through the 1970's. In addition to the few hundred job openings anticipated annually as a result of employment growth, an estimated 600 job openings are expected to result each year from the need to replace

experienced painters who retire or die. Opportunities also will occur as some painters transfer to other lines of work.

Employment of automobile painters is expected to increase primarily as a result of the increasing number of motor vehicles damaged in traffic accidents. The accident toll is expected to continue to increase as the number of motor vehicles in use grows, even though new and improved highways, driver training courses, added safety features on new vehicles, and stricter law enforcement may slow down the rate of increase. Despite the increasingly durable paint being used on new cars, the number of motor vehicles that need to be repainted because the original finishes have deteriorated also is expected to increase as a result of the growth in the number of motor vehicles in use.

The employment effect of increasing numbers of motor vehicles and traffic accidents may be offset slightly by the greater use of modern painting equipment and new developments in painting equipment that should enable painters to complete jobs in less time.

### Earnings and Working Conditions

Skilled automobile painters employed by automobile dealers had estimated average straight-time hourly earnings of \$3.96 in late 1966. Skilled painters generally earned between two and three times as much as inexperienced helpers and trainees.

Many automobile painters employed by automobile dealers and independent repair shops are paid a percentage of the labor cost charged to the customer. Under this method, a painter's earnings depend largely on the amount of work he is assigned and how fast he completes it. Earnings may be based also on other methods of wage payment—for example, a weekly salary plus a commission on jobs completed, or an hourly rate. Painters employed by trucking companies, buslines, and other organizations which repair their own vehicles

### Where Employed

An estimated 27,000 automobile painters were employed in late 1966. Almost two-thirds of these workers were employed in repair shops specializing in automobile-body repairs and painting, and in shops that do general automobile repairs. Most of the others were employed in the service departments of automobile and truck dealers. Some painters were employed by organizations that maintained and repaired their own fleets of motor vehicles, such as trucking companies and bus lines.

Although automobile painters are employed in every section of the country, about half of them work in the eight States with the largest number of automobiles: California, New York, Texas, Pennsylvania, Ohio, Michigan, Illinois, and New Jersey.

usually receive an hourly rate. Most painters work 40 to 48 hours a week.

Many employers of automobile painters provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Others also contribute to retirement plans. Painters in some shops are furnished with laundered uniforms free of charge.

Automobile painters are exposed to fumes from paint and paint-mixing ingredients. However, in most shops, the painting is performed in special ventilated booths that protect the painters from fumes. In shops not having such booths, painters are furnished with protective masks that cover the nose and mouth. Painters must be agile because they often bend and stoop at their work, but no more than average physical strength is needed.

Unions organizing automobile painters include the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most of the painters who are union members are employed by the larger automobile dealers and by trucking companies and buslines.

### Where To Go for More Information

For further information regarding work opportunities for automobile painters, inquiries should be directed to local employers, such as automobile-body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act of 1962, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile painters may be obtained from:

Automotive Service Industry Association,  
168 North Michigan Ave., Chicago,  
Ill. 60601.

Independent Garage Owners of America, Inc.,  
624 South Michigan Ave., Chicago,  
Ill. 60605.

### AUTOMOBILE TRIMMERS AND INSTALLATION MEN (AUTOMOBILE UPHOLSTERERS)

(D.O.T. 780.381 and .884)

#### Nature of Work

Automobile trimmers, frequently assisted by installation men, replace and repair upholstery and other automobile fabrics. (Workers who do upholstery work in automobile factories are not included in this statement.) Trimmers and installation men together are sometimes called "automobile upholsterers."

Automobile trimmers (D.O.T. 780.381) are skilled upholsterers who custom make coverings for automobile seats, floors, and door panels; convertible tops; and other items. In making such items, they first determine the dimensions of each piece of vinyl, leatherette, broadcloth, or other material to be used and mark the material for cutting. When determining dimensions, trimmers must make allowances for pleats, seams, shrinkage, and stretching. Although trimmers follow standard designs in making most items, at times they follow original designs specified by customers or create original designs. After cutting and fitting the pieces, they stitch them together using heavy-duty sewing machines. Finished pieces are stretched and pulled to fit snugly; glued, tacked, stapled, or fastened in other ways;

and then trimmed of excess material. In addition to making automobile upholstery and convertible tops, trimmers may make such items as truck seat cushions and tarpaulins, boat covers, and seats for small airplanes. They repair upholstery that has been torn, cut, burned, or damaged in other ways. They may also repair power-window and convertible top mechanisms, and cut and install automobile glass.

Automobile trimmers often are assisted by *installation men*, sometimes called seat-cover installers (D.O.T. 780.884). Installation men remove the worn seat covers and convertible tops and install new ones so that trimmers may concentrate on making upholstery.

Trimmers and installation men use a variety of handtools including shears, knives, screwdrivers, special pliers, various types of wrenches, tack hammers, mallets, and tape measures. They also use heavy-duty sewing machines and power tools such as air-powered staplers and wrenches. In some shops, they use electric steaming machines for shrinking fabrics, and special electronic welders for binding synthetic materials.

#### Where Employed

An estimated 8,000 automobile trimmers and installation men were employed in late 1966. Most of them



Automobile trimmer sews seat covers.



worked in shops that specialize in the fabrication and replacement of automobile upholstery and convertible tops. Others worked in automotive repair and accessories sections of department stores, in automobile-body repair shops, and in automobile dealer shops. Most automobile upholstery specialty shops employ from 1 to 5 trimmers. In small shops, the number of installation men generally equals the number of trimmers. Installation men outnumber the trimmers, however, in many of the larger shops, particularly those that specialize in the installation of factory-made seat covers and tops.

Although automobile upholsterers are employed throughout the country, most work in the larger cities and towns.

### **Training, Other Qualifications, and Advancement**

Most trimmers and installation men learn their skills informally on the job. Beginners are usually hired as installation men trainees. They are first taught to remove seats and upholstery and install seat covers, and gradually learn to do more difficult jobs such as installing convertible tops. After qualifying as installation men, they progress to making seat covers, tops, and other upholstery. Although a capable beginner can become a fully qualified installation man in as little as 3 to 6 months, it usually takes 3 to 4 years longer to become a skilled trimmer.

A small number of automobile trimmers begin as apprentices. Apprenticeship programs for automobile trimmers, which generally last 3 or 4 years, consist of on-the-job training supplemented by related classroom instruction.

Applicants for entry jobs should be mechanically inclined and in good physical condition. Employers are particularly interested in hiring those who enjoy doing creative work with their hands. A high school education

is desirable but not essential. High school and vocational school courses in furniture upholstery provide valuable training. Courses in mathematics are useful because of the calculations involved in laying out and planning automobile upholstery work.

Experienced trimmers who have supervisory ability may advance to foremen in large shops. Many automobile trim shops are owned by trimmers who acquired the necessary experience, skill, and capital to establish their own businesses.

### **Employment Outlook**

A few hundred job openings for automobile trimmers and installation men are expected annually through the 1970's. Most of these openings will result from the need to replace experienced workers who retire, die, or transfer to other lines of work. Growth of the occupations is expected to provide a small number of job opportunities annually, primarily because the growing number of automobiles in use, especially convertibles, is expected to increase the demand for custom made automobile upholstery and other fabric products. However, the demand is not expected to grow as rapidly as the number of automobiles, because of the use of more durable fabrics. Other factors that should stimulate employment growth include an increasing demand for truck cushions and tarpaulins as a result of the growing number of trucks in use, and an increasing demand for custom made boat covers and seats as a result of the growing popularity of boating.

### **Earnings and Working Conditions**

Most trimmers and installation men are paid a weekly salary or hourly wage and work from 44 to 48 hours per week. Many receive commissions or bonuses based on sales, in addition to their regular pay. Some

trimmers are paid on a straight commission basis.

Starting pay for installation men trainees ranged from \$55 to \$80 in early 1967, based on information obtained from a limited number of employers. Experienced installation men generally earned \$85 and \$125 per week. Most trimmers earned between \$125 and \$200 per week.

Many employers of trimmers and installation men provide holiday and vacation pay and pay all, or part, of the cost of additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans.

Trimmers and installation men generally work in shops that are clean, well-lighted, and relatively quiet. Their work often involves getting into awkward and uncomfortable positions for short periods. Automobile upholstery work is not considered hazardous, although these workers are subject to cuts, bruises, and other minor injuries.

A small percentage of these workers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

### **Where To Go for More Information**

For further information regarding work opportunities for automobile trimmers and installation men, inquiries should be directed to local automobile trim shops or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act of 1962, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile trimmers and installation men may be obtained from:

National Association of Auto Trim Shops,  
129 Broadway, Lynbrook, L.I., N.Y.  
11563.

## BLACKSMITHS

(D.O.T. 356.381 and 610.381)

### Nature of Work

Blacksmiths make and repair many different kinds of metal articles and parts, such as forging tongs and other tools, machine frames, automobile parts, and other industrial and agricultural equipment. They also sharpen hand and machine tools, such as chisels, drills, and picks. They do their work by shaping and sometimes joining together (forge welding or fire welding) glowing hot metal which has been heated in a special type of furnace called a forge. In performing the shaping and joining processes, blacksmiths hammer heated metal on an anvil. They use handtools, such as hammers, tongs, and chisels, and also may use welding equipment, grinders, presses, and power hammers.

After a metal article or part has been formed, the blacksmith may heat-treat it to harden and temper it properly. He hardens the metal by heating it to a high temperature and then cooling it quickly in an oil or water bath. To temper the metal (make it tougher and less brittle), he also heats it, but to a lower temperature than is needed for hardening, keeps the metal at this lower temperature for a specified time, and then lets it cool gradually in the air.

Job duties of blacksmiths are similar to those of many forge shop workers, who operate heavy machinery to shape and form articles from heated metal. (For a detailed discussion of jobs and job opportunities in forge shops, see the section on Forge Shop Occupations.)

### Where Employed

About two-thirds of the approximately 16,000 blacksmiths employed in the United States in early 1967 were industrial blacksmiths. The remainder worked in small shops where

they repaired tools and other equipment and performed other services, such as welding and tool sharpening, or specialized in the shoeing of horses. More than four-fifths of the blacksmiths in small repair shops were self-employed.

Industrial blacksmiths were employed in a variety of industries, mostly for maintenance and repair work. Nearly half of them worked in manufacturing industries, especially in the basic iron and steel industry and in the machinery, transportation equipment, and fabricated metal products industries. About one-fifth of industrial blacksmiths worked in mining industries, chiefly in the extraction of crude petroleum and natural gas. (Where oil wells are being drilled, for example, blacksmiths sharpen and temper drill bits, repair tools, and assist drillers in the operation and maintenance of drilling equipment.) The railroads and the construction industry also employed relatively large numbers of blacksmiths.

Blacksmiths work in all parts of the country, in small rural communities as well as in large industrial centers. However, employment is concentrated in Pennsylvania, Texas, California, Illinois, Ohio, and New York.

### Training and Other Qualifications

Most workers enter the occupation by getting jobs as helpers in blacksmith shops, where they gradually learn the trade. Others enter through formal apprenticeship training programs, which generally last 3 or 4 years and customarily provide training in blueprint reading, the use of tools and equipment, heat-treatment of metal, and forging methods, including forge welding. Most apprentices are found in large industrial firms rather than in small repair shops. Vocational school or high school courses in metalworking, blueprint reading, and mathematics are helpful to young persons interested in becoming blacksmiths.

Blacksmiths must have a skilled touch in order to shape metal parts to specified dimensions. They must also be in good physical condition. Pounding metal into shape and handling heavy tools and metal parts for an entire working day require considerable strength and stamina. The use of power hammers and hoists, however, reduces the physical demands of the work.

### Employment Outlook

The number of blacksmiths is expected to decline slowly through the 1970's. However, several hundred job openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The employment of blacksmiths is expected to decline in the years ahead because forge shops are producing a growing variety of small metal articles formerly made by blacksmiths, and because the metalworking operations once performed only by blacksmiths are increasingly being done by other workers such as welders and forge shop craftsmen. In addition, it is now cheaper to replace many small parts than to have them repaired by blacksmiths. However, the skills of all-round blacksmiths will continue to be needed in the maintenance departments of large industrial establishments, in many small metalworking and repair shops, and to shoe horses.

### Earnings and Working Conditions

National earnings data are not available for blacksmiths. However, earnings data are available from union-management contracts, in effect in mid-1966, covering a large number of blacksmiths employed in steel plants, railroad shops, and in the shipbuilding and petroleum industries. Although these contracts show a wide range of earnings for experienced blacksmiths, the majority of the contracts called for straight-

time hourly earnings ranging from about \$2.90 to more than \$3.60. Contracts covering blacksmiths in the petroleum industry specified hourly rates ranging from about \$3.20 to slightly more than \$3.60. Industrial blacksmiths generally work the same number of weekly hours and have the same holiday, vacation, and other benefits as other plant workers in those industries in which they work.

Blacksmith shops tend to be hot and noisy because of the furnaces and hammers, although heat and noise have been decreased in recent years by the introduction of large ventilating fans and the lessening of machine vibration. Blacksmiths are subject to a number of job hazards, such as burns from forges and heated metals and cuts, bruises, and other injuries from manual handling of materials. Increased use of personal protective equipment, such as safety glasses, metal helmets, metal-tip shoes, instep guards, face shields, ear plugs, and leather aprons, has helped to decrease the number of injuries.

Many blacksmiths belong to unions. One important union in the trade is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other unions representing blacksmiths include the United Steelworkers of America and the International Union of Journeymen Horseshoers.

### Where To Go for More Information

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers.  
Eighth at State Ave., Kansas City, Kans. 66101.

## BOILERMAKING OCCUPATIONS

### Nature of Work

Boilermakers, layout men, and fitup men are skilled workers who spe-

cialize in the repair, fabricating, and assembling and disassembling of boilers, tanks, vats, pressure vessels, heat exchangers, and similar structures made of metal plate. These boilers and other vessels are used widely throughout industry to hold liquids and gases under pressure. Boilermakers are primarily engaged in erecting and repairing boilers and vessel; layout men and fitup men usually are employed in manufacturing new boilers and heavy tanks. The repair work performed by boilermakers requires these workers to have all-round skills; fitup men and layout men have more specialized duties.

*Boilermakers* (D. O. T. 805.281). These craftsmen assemble and erect prefabricated parts and fittings, at construction sites where the boilers or other pressure vessels are to be used. After installation is completed, they conduct tests to check for defects. Boilermakers also do repair work in the field. After first determining the cause of trouble, they may then dismantle the boilers or other units and make repairs, such as patching weak spots with metal stock, replacing defective sections with new parts, or strengthening joints. In addition to those working at construction sites, a large number of boilermakers maintain and repair boiler and other pressure vessels in the powerplants of industrial firms. Installation and repair work performed by boilermakers, must often meet standards set by State and local laws covering boilers and other pressure vessels.

Many large boilers are assembled at the plants of the manufacturers and shipped as completed packages. Boilermakers often are employed to do this assembly work, and they use the same skills for plant work as for field work.

Boilermakers use a variety of tools and equipment in their 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

assembling and erecting steel plate units at a field construction site, they may use all types of rigging equipment including hoists, jacks, and rollers.

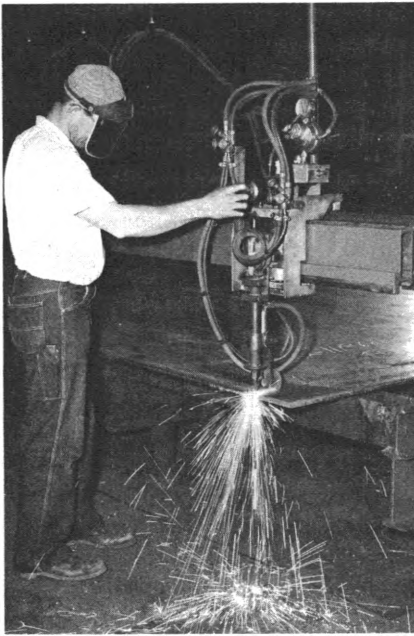
*Layout Men* (D.O.T. 809.381 and .781). Metals used in the manufacture of boilers, tanks, vats, and other pressure vessels initially are prepared for fabricating operations by layout men. These workers mark on metal plates and tubes all curves, lines, points, and dimensions, which serve as directions to other workers for cutting or shaping the parts required for the pressure vessel being fabricated. They lay out parts to scale as outlined on blueprints, sketches, or patterns. Layout men use compasses, dividers, scales, surface gages, hammers, and scribes in their work.

*Fitup Men* (D.O.T. 819.781). Before the various parts of boilers, tanks, vats, and other pressure vessels finally are assembled, fitup men temporarily assemble and fit them together in the shop. They bolt or tack-weld parts together and correct irregularities. Fitup men also 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

About 25,000 boilermakers, layout men, and fitup men were employed in the United States in early 1967. Several thousand were employed in the construction industry, mainly to assemble and erect boilers and other pressure vessels. Boilermakers also were employed in the maintenance and repair departments of firms in industries such as iron and steel manufacturing, petroleum refining, railroad transportation, and electric and



Workman cuts steel sheet for boiler construction.

gas utilities. Large numbers worked in Federal Government installations, principally in Navy shipyards and Federal powerplants. Layout men and fitup men were employed mainly in establishments that fabricate fire-tube and water-tube boilers, heat exchangers, heavy tanks, and similar boiler-type items.

Boilermakers are employed in every State because of the widespread need for their skills in repair and installation work. Large numbers are located in the Middle Atlantic and East North Central regions, where the metalworking industries are concentrated. Most layout men and fitup men work in these two regions also. Pennsylvania, California, Texas, Illinois, Ohio, New York, and New Jersey are among the leading States in numbers of boilermaking craftsmen.

### Training and Other Qualifications

Many men have become boilermakers by working for several years as helpers to experienced boilermakers, but 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 boilermaker who instructs him in the skills of the craft, including the proper way to use the tools and machines of the trade. Apprenticeship programs usually provide for about 8,000 hours of relatively continuous employment and training, supplemented by about 600 hours of related technical instruction. Some of the related technical subjects studied by apprentice boilermakers are blueprint reading, shop mathematics, welding techniques, and shop metallurgical science covering stress and strain of metals.

Many layout men and fitup men acquire their skills on the job. They usually are hired as helpers and learn the craft by working with experienced workers. It generally takes at least 2 years to qualify as an experienced layout or fitup man in a fabricating shop where boilers and other pressure vessels are produced on a mass-production basis. In shops where products are custom made, layout and fitup jobs generally are filled by men who have first qualified as skilled boilermakers.

Most employers prefer to hire beginning workers who have a high school education. Prior training in mathematics, blueprint reading, and shopwork is helpful to young men interested in becoming boilermakers, layout men, or fitup men. Most firms require prospective employees to pass a physical examination, because good physical health and the capacity to do heavy work are necessary qualifications for work in these occupations. Mechanical aptitude and manual dexterity also are important qualifications.

### Employment Outlook

Employment of boilermakers, layout men, and fitup men is expected to increase slowly through the remainder of this decade and throughout the 1970's. Most job openings, therefore, will arise from the need to replace

experienced workers who retire, transfer to other fields of work, or die. Retirements and deaths alone are expected to result in approximately 600 job openings annually.

The anticipated slow rise in employment of boilermakers, layout men, and fitup men in the decade ahead will occur mainly because of growth in the Nation's general economic activity. Such economic expansion will result in growth of industries that use boiler products—particularly the electric and gas utilities, chemical, steel, and construction industries. In addition to increased demand for boiler products, the trend toward very large, increasingly complex, custom-made boilers is expected to spur employment of skilled boilermakers to erect such equipment on the site. In shops which fabricate boiler products, however, growth in the number of boilermakers, layout men, and fitup men may be limited by the increasing use of more efficient production techniques and equipment, including improved materials handling methods and welding equipment.

### Earnings and Working Conditions

Wage rates of skilled boilermaking workers compare favorably with those of other craftsmen. Layout men generally are paid more than boilermakers or fitup men, although wages vary widely in each occupation because of differences in such factors as the experience and skill of the worker, the kind of industry in which he is employed, and the geographical region in which he works.

Boilermakers in field assembly and installation (construction) work generally receive higher hourly wage rates than boilermakers, layout men, and fitup men employed in industrial establishments, although they may not be employed as steadily. According to a national survey of building trades workers in the construction industry, union minimum hourly wage rates for boilermakers in 56 large cities averaged \$4.90 as of July 1965. Among the individual cities surveyed,

the minimum hourly rates for boiler-makers included in the survey ranged from \$4.35 in Tampa and Jacksonville, Fla., Memphis and Knoxville, Tenn., Charlotte, N.C., and Atlanta, Ga., to \$5.90 in New York City. Comparable data were not available covering boiler-makers employed in industrial establishments. However, information on minimum hourly wage rates was available from union-management agreements, in effect in mid-1966, covering a large number of boiler-makers, layout men, and fitup men employed in the fabricated plate work, petroleum, and shipbuilding industries. The majority of these agreements called for minimum hourly wage rates ranging from \$3.25 to about \$4.15 for layout men; from slightly less than \$3 to about \$3.90 for boiler-makers; and from about \$2.75 to \$3.70 for fitup men.

Boiler-makers, layout men, and fitup men in industrial establishments usually work the same number of weekly hours as other plant workers, generally 40 hours. Most of the union-management agreements covering these workers provide for fringe benefits such as hospitalization, and medical and surgical insurance; paid vacations; life insurance; sickness and accident insurance; and retirement pensions.

When engaged in boiler repair and assembly work, boiler-makers often are required to work in cramped quarters or at great heights. Some work also must be done under conditions of dampness, heat, and poor ventilation.

Boilermaking is more hazardous than many other metalworking occupations. Employers and unions attempt to eliminate injuries in boiler-shops by promoting safety training and the use of protective equipment, such as safety glasses and metal helmets.

Most boiler-makers, layout men, and fitup men belong to labor unions. The principal union in these trades is the International Brotherhood of Boiler-makers, Iron Shipbuilders, Blacksmiths, Forgers, and Helpers. Some boilermaking craftsmen are

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 Boiler-makers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers,  
Eighth at State Ave., Kansas City,  
Kans. 66101.

### DISPENSING OPTICIANS AND OPTICAL MECHANICS

(D.O.T. 713.251, .381, .884, and 299.-884)

#### Nature of Work

Dispensing opticians and optical mechanics (also called optical laboratory technicians) make and fit eyeglasses prescribed by eye physicians (oculists or ophthalmologists) and optometrists to correct defective vision. Optical mechanics grind and polish lenses to the specifications of prescriptions, and assemble lenses in frames. Dispensing opticians then fit and adjust the finished glasses to the customer's facial features. In some States, dispensing opticians also fit contact lenses. These lenses are worn in contact with the eyes and are used as a substitute for or supplement to conventional eyeglasses. Occasionally, both the fabricating and fitting of glasses are performed by the same person.

The *dispensing optician* works in a retail optical establishment. He makes certain that the glasses follow the prescription and fit the customer properly. The optician determines exactly where the lenses should be placed in relation to the pupils of the eyes by measuring the distance between the centers of the pupils. He also assists

the customer in selecting the proper eyeglass frame by measuring the customer's facial features and giving consideration to the various styles and colors of the eyeglass frames.

Before prescription eyeglasses are fitted, the dispensing optician prepares a work order which gives the optical mechanic the information he needs to interpret the prescription properly, grind the lenses, and insert them in a frame. The work order consists of the lens prescription; information on the size, tint (where appropriate), optical centering of the lens, and other optical requirements; and the size, color, style, and shape of the frame. After the eyeglasses are made, the optician adjusts the frame to the contours of the customer's face and head to make sure they fit properly and comfortably. He uses small handtools, such as optical pliers, files, and screwdrivers, and also uses a precision instrument to check the power and surface quality of the lenses. In some shops, he may do lense grinding and finishing, and sell other optical goods such as binoculars, magnifying glasses, and nonprescription sunglasses.

In fitting contact lenses, the dispensing optician, following the physician's or optometrist's prescription, measures the cornea of the customer's eye and then prepares specifications to be followed by a firm specializing



Dispensing optician fits glasses for proper functioning and attractive appearance.

in finishing such lenses. The dispenser uses precision instruments to measure the power and curvature of the lenses and the curvature of the cornea of the eye. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. The dispensing optician instructs the customer in the insertion, removal, and care of the contact lenses during the initial period of adjustment, which may last several weeks. The physician or optometrist rechecks their fit, as needed. If minor adjustments are necessary, the dispensing optician makes them; if major changes are needed, he returns the lenses to the contact lens manufacturer.

The *optical mechanic* performs the shop or laboratory work required to make prescription eyeglasses; but he does not make contact lenses, which involve somewhat different operations. The two principal types of optical mechanics are the *surfacers* (or prescription lens grinder) and the *benchman* (or finisher). The *surfacers*, starting with standard or stock size lens blanks, lays out the work, grinds and polishes the surfaces of the lenses, and makes sure that the ground lenses conform to the prescription requirements. In small laboratories, one man may perform all of these operations and benchwork also. In large laboratories, the work is divided into separate operations which are performed mainly by semiskilled workers who operate power grinding and polishing machines. The *surfacers* uses precision instruments to measure the power of the lenses.

The *benchman* marks and cuts the ground and polished lenses to fit the frame, bevels or smooths the edges of the lenses, and assembles the lenses and frame parts into the finished eyeglasses. In large laboratories, these duties are divided into several operations which are performed mainly by semiskilled workers. The *benchman* uses small handtools, such as lens cutters, chippers, pliers, files, protractors, and diamond point glass drills. He

also uses precision instruments to determine, for example, if there are any imperfections in the lenses.

### Where Employed

An estimated 7,000 dispensing opticians and 15,000 optical mechanics were employed throughout the country in early 1967. About 70 percent of all dispensing opticians were employed by retail optical shops or the optical departments of department stores and other retail establishments; about 20 percent were employed by eye physicians or optometrists who sell eyeglasses directly to their patients. The remainder worked in the prescription departments of wholesale optical laboratories that did work for retail optical firms; in special prescription shops in large ophthalmic goods factories; or were employed by hospitals, government agencies, construction firms, and mining companies. Nearly 70 percent of the mechanics worked in wholesale optical laboratories, and about 25 percent worked in retail optical shops; the rest worked for the same types of employers as did opticians.

In addition to the dispensing opticians and optical mechanics mentioned above, many others are proprietors of retail optical establishments.

A few thousand women are employed in these trades. Many of them work as dispensing opticians in retail optical outlets.

Although opticians and mechanics are found in all States, more than half are located in the following States: New York, Massachusetts, Pennsylvania, Texas, California, and Illinois.

### Training, Other Qualifications, and Advancement

Most optical mechanics and dispensing opticians learn their skills through informal, on-the-job training. Trainees start in jobs requiring

simple skill and dexterity and gradually work into the more difficult jobs. For example, they may begin by processing lenses through a lens grinding machine. After they have become skilled in this operation, the trainees perform other production operations, such as polishing, edging, lens cutting, and eyeglass assembly. Their training may include instruction in the measurement and curvature of lens surfaces, the measurement of lenses, and other subjects related to their work. When the trainees have acquired experience in all types of eyeglass production work, which usually takes about 3 years, they are considered all-round optical mechanics. Some trainees become specialists on one type of work performed by optical mechanics, such as surfacing or bench work. The training time required to become a specialist generally is less than that needed to become an all-round mechanic.

Most dispensing opticians acquire their training in dispensing offices under the guidance of experienced opticians. They usually have had prior training in optical mechanics, but a growing number start without this background. On-the-job training in dispensing work may last several years and usually includes instruction in optical mathematics, optical physics, the use of precision measuring instruments, and other related subjects.

High school graduates can prepare for both optical dispensing and mechanical work through formal apprenticeship programs. Most training authorities agree that optical mechanics and dispensing opticians who learn as apprentices have more job opportunities, improved job security, and more opportunities for advancement than those without such training. Some optical firms have 4- or 5-year apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period.

The typical program for an optical mechanic apprentice in eyeglass lens

production includes on-the-job training and related instruction in ophthalmic optics (vision improvement). It also includes instruction in subjects such as types and measurement of lenses, the measurement and curvature of lens surfaces, and the effect of glass surfaces on light rays. 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 surfer emphasizes training in grinding operations, polishing, blocking, inspection, and layout. The benchman apprenticeship program concentrates on lens edging, layout for cutting, lens cutting and drilling, rimless spectacle assembly, inserting lenses into frames, and inspection of eyeglasses.

The dispensing optician apprentice is given training similar to that of the benchman apprentice. He receives additional instruction in optical mathematics, optical physics, physiology of the eye, use of precision measuring instruments, interpretation of prescriptions, the mechanics of dispensing, and the inspection of eyeglasses.

Formal training for the dispensing optician is becoming increasingly common. In 1967, three schools offered 2-year full-time courses in optical fabricating and dispensing work. Another school offered a 2-year home study course in optics and optical dispensing to supplement the training of apprentices in retail optical dispensing shops. A few vocational schools have courses for optical mechanics. Large manufacturers of contact lenses offer courses of instruction in contact lens fitting, usually lasting a few weeks.

Employers prefer applicants for entry jobs as dispensing opticians and optical mechanics to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in, and ability to do,

precision work are essential. Because dispensing opticians deal directly with the public, they must be tactful and have a pleasing personality.

In early 1967, 17 States had licensing requirements governing dispensing opticians: Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Virginia, and Washington. Some of these States also require licenses for optical mechanics in retail optical shops or for the retail optical shop itself. Some States permit dispensing opticians to fit contact lenses while others prohibit them from doing so. To obtain a license, the applicant generally must meet certain minimum standards of education and training and also pass a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Optical mechanics can become supervisors, foremen, and managers. Many of them have become dispensing opticians, although there is a trend to train specifically for dispensing optician jobs. There are opportunities for workers in both occupations to go into business for themselves, especially for those with all-round training in both shop and dispensing work. Opticians may also become managers of retail optical stores. Some opticians may become salesmen for wholesale optical goods companies or for manufacturers of conventional eyeglasses or contact lenses.

### Employment Outlook

Employment of dispensing opticians is expected to increase moderately during the remainder of this decade, and through the 1970's. In addition to the opportunities resulting from employment growth, about 200 job openings will result annually from the need to replace experienced workers who retire or die. Some ad-

ditional job openings will become available as workers transfer to other occupations.

Little employment change is expected for optical mechanics throughout the 1970's. Several thousand job openings, however, will be available because of the need to replace experienced mechanics who retire, transfer to other occupations, or die. Retirements and deaths alone should result in about 300 job openings each year during this period.

The production of prescription lenses is expected to increase considerably during the period. Factors that will contribute to this growth include the increasing size, and the rising literacy and educational level of the population: a large increase in the number of older persons (a group most likely to need eyeglasses); and the growing emphasis on good vision (more than half the population over 6 years of age now wear eyeglasses). In addition, the many different styles and colors of eyeglass frames now available have increased the number of pairs of eyeglasses purchased by individuals and encouraged the wearing of eyeglasses.

The increase in production of prescription lenses will result in growing employment of dispensing opticians. However, principally as a result of more efficient methods of production and improved equipment, employment of optical mechanics is not expected to increase.

### Earnings and Working Conditions

National earnings data are not available for optical mechanics and dispensing opticians. However, data obtained from firms employing a large number of these workers indicated that weekly earnings of mechanic trainees ranged from about \$60 to \$90 in early 1967; those of experienced mechanics ranged from about \$90 to approximately \$160. Dispensing opticians usually earn about 10 to 20 percent more than mechanics. Opticians who have their

own businesses may earn much more. Foremen earn up to 20 percent more than skilled workers, depending on their experience, skill, and responsibilities. Apprentices start at about 60 percent of the skilled worker's rate; their wages are increased periodically, so that upon completion of the apprenticeship program, they receive the beginning rate for journeymen. 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 usually have year-round employment.

The work of the dispensing optician requires little exertion and is generally performed in pleasant, well-lighted, and well-ventilated surroundings. Optical mechanics may work under fairly noisy conditions because power grinding and polishing machines are used. New machines are much quieter, however.

Physically handicapped persons who have full use of their eyes and hands and can do sedentary work can perform some of the more specialized jobs in the larger laboratories.

Some optical mechanics and dispensing opticians are members of unions. One of these unions is the International Union of Electrical, Radio and Machine Workers.

### Where To Go for More Information

American Optical Co.,  
Box 1, Southbridge, Mass. 01551.

Bausch and Lomb, Inc.,  
635 St. Paul St., Rochester, N.Y.  
14602.

Optical Wholesalers Association,  
222 West Adams St., Chicago, Ill.  
60606.

International Union of Electrical,  
Radio and Machine Workers,  
1126 16th St. NW., Washington, D.C.  
20036.

The following organizations can provide general information, including the names of vocational schools:

Guild of Prescription Opticians of  
America,  
1250 Connecticut Ave. NW., Wash-  
ington, D.C. 20036.

American Board of Opticianry,  
821 Eggert Rd., Buffalo, N.Y. 14226.

## ELECTROPLATERS

(D.O.T. 500.380, .782, and .884)

### Nature of Work

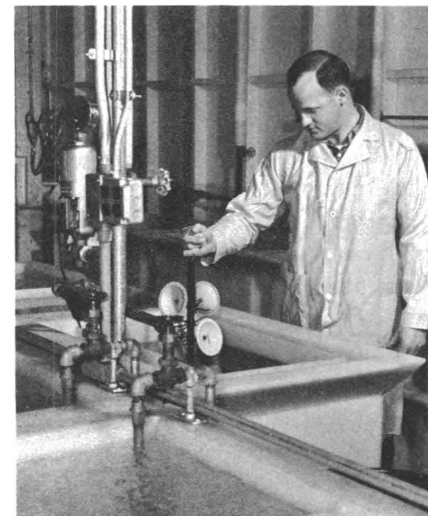
Electroplaters (platers) use plating solutions and electric current (electrolysis) to coat metal articles with a layer of chromium, nickel, silver, gold, or other metal to give them a protective surface, or a more attractive appearance. Metal products that are often electroplated include items as widely different as automobile bumpers, cigarette lighters, silverware, costume jewelry, plumbing fixtures, electrical appliances, bearings, electronic components and jet engine parts. Electroplaters also form objects by electrolysis. These include items such as spray paint masks, search light reflectors, and a variety of molds used in the manufacture of plastic items.

Platers' skills vary broadly among plating shops. All-round platers who work in job shops that do small lot plating of great variety may mix and analyze plating solutions, calculate the time and electric current needed for various types of plating, and perform other duties requiring a technical knowledge of the plating process. Platers who work in production shops, where large lots of metal parts of the same type are plated, usually carry out less difficult, more specialized assignments that require only limited technical knowledge.

In preparing an article for electroplating, the plater cleans it by dipping it in cleansing solutions, or by scouring it. He masks any surface not to be plated by covering it with lacquer, rubber, or plastic tape. To achieve

the plating required by the specifications, he determines, or receives instructions from the foreman on the amount of electric current needed, the time required to plate the article, and the plating solution to use. He then places the article in a tank containing the plating solution, and adjusts the current so that the metal in the solution will be deposited on the surface of the article at the rate that will assure a good plating finish. The plater may remove the article from the solution at intervals to check on the progress of the plating. If the plating is not progressing satisfactorily, he makes the necessary adjustments or notifies his supervisor. Platers must be observant in their work because errors that go unnoticed can be very costly.

When the article is plated, the plater removes it from the solution and inspects the plating. On many types of plating work, the plater inspects objects only for visible defects. On jobs that require very close tolerances, the plater may use micrometers, calipers, and electronic devices to determine the quality of the work. Electroplaters frequently are assisted by helpers who place objects on racks before plating, remove them afterwards, and then clean tanks and racks. In some shops, platers order chemicals and other supplies for their work.



Electroplater inspects batch of plastic items immersed in nickel solution.



### Where Employed

An estimated 13,000 electroplaters were employed in early 1967. About 2 out of 3 worked in independent job shops specializing in metal plating and polishing for other manufacturing firms and for individuals. 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.

Electroplaters are employed in almost every part of the country, although most work in the Northeast and Midwest near the centers of the metalworking industry. Large numbers of electroplaters work in Los Angeles, Chicago, New York, Detroit, Cleveland, Providence and Newark (New Jersey).

### Training, Other Qualifications, and Advancement

Most electroplaters are hired as helpers and learn the trade on the job by working with experienced platers. It usually takes 3 years or longer to become an all-round plater in this way. Platers employed in production shops who are not required to have an all-round knowledge of plating can learn their jobs in much less time.

Another way to enter the electroplating trade is through an apprenticeship program, which lasts 3 or 4 years. Although apprentice training provides all-round preparation, only a small percentage of electroplaters have been trained this way.

The 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. Qualified journeymen may advance to foremen.

High school and vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading will prove valuable to young persons interested in becoming 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.

### Employment Outlook

A few hundred job opportunities for electroplaters are expected each year in the late 1960's and in the 1970's. Most of these will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Continuing mechanization of the electroplating process and the practice of assigning some of the plater's technical responsibilities to chemists and foremen will limit employment growth in this occupation. However, it is expected that these factors will be more than offset by the long-run expansion in the machinery and metalworking industries, and the application of the electroplating processes to a broadening group of metals and plastics.

### Earnings and Working Conditions

Wage rates of electroplaters ranged from about \$1.55 to \$3.50 an hour in 1966, according to a recent survey of about 170 firms engaged in electroplating. All-round platers, generally earned more than \$2.50 an hour. During a worker's period of apprentice-

ship or on-the-job training, his wage rate usually starts at about 60 to 70 percent of an experienced 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. Many employers provide paid holidays and vacations and pay part or all of additional benefits such as life, health, and accident insurance.

Plating work involves some hazards because acid, alkaline, or poisonous solutions are used. Humidity and odor are also problems 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. Mechanical devices generally are used to handle most of the lifting required, but at times the worker must lift and carry objects weighing up to 100 pounds.

Some platers are members of the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, and the International Association of Machinists and Aerospace Workers. Some of the labor-management contracts covering electroplating provide health insurance and other benefits.

### Where To Go for More Information

For educational information concerning electroplating and other metal finishing methods, write to:

American Electroplaters Society, Inc.,  
56 Melmore Gardens, East Orange,  
N.J. 07017.

For information on job opportunities, training, and other questions, write to:

National Association of Metal Finishers,  
248 Lorraine Ave., Upper Montclair,  
N.J. 07043.

## FURNITURE UPHOLSTERER

(D.O.T. 780.381)

### Nature of Work

Upholstered furniture that has become old and worn is reconditioned by furniture upholsterers who may replace worn furniture fabric, repair broken frames, or replace or repair bent springs, webbing, and other worn parts of furniture. The upholsterer usually places the piece of furniture on padded wooden horses so that he may work at a convenient level. Then, using a tack puller or chisel and mallet, he pulls out the tacks which hold the fabric in place and removes the fabric. He may also remove the padding and burlap that cover the springs. The springs are then examined and the broken and bent ones are removed. If the webbing which holds the springs in place is worn, all of the springs and the webbing may be ripped out. The upholsterer then makes all needed repairs to the frame, such as regluing loose sections and refinishing worn wooden arms.

To reupholster the furniture, the upholsterer first tacks strips of webbing to the frame. Next, he sews new springs to the webbing and ties each spring to the adjoining ones, securing the outside springs to the frame. He then uses burlap, filling, and padding to cover the springs, and sews the padding to the burlap. Finally, after the upholsterer covers the padding with muslin and new fabric, he attaches these materials to the frame, making sure that they are smooth and tight. He completes the job by sewing or tacking on fringe, buttons, or other ornaments ordered by the customer.

Upholsterers use a variety of handtools in their work, including tack and staple removers, pliers, hammers, and shears. They also use special tools such as webbing stretchers and upholstery needles. Upholsterers who work in small shops may



Furniture upholsterer nails cording to chair arm.

lay out patterns on upholstery fabric and cut the fabric using hand shears or cutting machines. They may also operate sewing machines to form new upholstery covers. In large shops, however, these tasks are usually performed by seamstresses. Sometimes, upholsterers pick up and deliver furniture. Those who own their own shops order supplies and equipment, keep business records, and perform other managerial and administrative tasks. (This statement does not include furniture upholsterers who manufacture upholstered furniture.)

### Where Employed

More than one-half of the estimated 32,000 furniture upholsterers employed in early 1967 worked in small upholstery shops, frequently in shops with fewer than eight employees. Many upholsterers were also employed by furniture stores, and a few worked for organizations—movie theatres, hotels, motels, and others—that maintain their own furniture.

Employment of furniture upholsterers is distributed geographically in much the same way as the Nation's population. Thus, they are employed mainly in major metropolitan areas and in the highly populated States. Almost one-half of the upholsterers employed in early 1967 worked in

New York, California, Pennsylvania, Texas, Illinois, and Ohio.

### Training, Other Qualifications, and Advancement

The most common way to learn the trade is to complete an informal on-the-job training program in an upholstery shop. Prospective upholsterers are hired as helpers to perform simple jobs, such as removing old fabric, padding, and springs from furniture. As they gain experience, they perform more complex tasks, such as installing webbing and springs and sewing on upholstery fabric and trimming. Inexperienced helpers who have initiative may become skilled upholsterers after completing 3 years of on-the-job training.

Upholsterers can learn their skills while employed as plant workers in furniture factories by getting experience in a variety of plant jobs that are closely related to furniture upholstering. They may also learn upholstering while in high school by completing vocational courses that include chair caning, furniture making, textile fabrics, and upholstery repair. However, on-the-job training is usually required before these workers can qualify as journeymen upholsterers.

A few people acquire the skills of the trade through formal apprenticeship programs that last from 3 to 4 years and include related classroom instruction.

Young people interested in becoming furniture upholsterers should have good manual and finger dexterity. They must be able to do occasional heavy lifting. Good sight, an eye for detail, and an ability to distinguish between colors are important. A flair for creative work is helpful.

Furniture upholsterers usually furnish their own handtools, which cost from \$30.00 to \$40.00. Power tools are provided by employers.

Almost 1 out of every 3 upholsterers is self employed—a higher proportion than in most other trades. Opening an upholstery shop usually re-

quires an initial investment of \$3,000 to \$5,000.

### Employment Outlook

Overall employment of upholsterers is expected to show little or no change during the remainder of the 1960's and throughout the 1970's. Most job openings will result from the replacement of experienced workers who die, retire, or transfer to other fields of work. Deaths and retirements alone are expected to provide more than 600 job openings annually. There have been many unfilled job openings in this trade in recent years because the supply of qualified workers has been insufficient to meet the demand. Moreover, this shortage may continue for several years, because the number of people currently being trained is still insufficient to meet anticipated future requirements.

Among the factors tending to increase requirements for furniture upholsterers are the growing expenditures for furniture, the growth in family formation, and the higher levels of personal incomes. However, the rising cost of reupholstering furniture relative to replacing it is expected to offset the requirements for upholsterers that will arise from these factors.

### Earnings and Working Conditions

Earnings data for furniture upholsterers are not available on a national basis. However, information obtained from a small number of employers across the country in late 1966 indicated that rates for helpers ranged from \$1.25 to \$1.75 per hour, and for experienced upholsterers, from \$2.00 to \$4.50 per hour. A few upholsterers were paid on a piecework basis. The hourly rates for upholsterers depended on such factors as their level of skill, the length of time they had been employed, and the type and geographic location of the establishment in which they worked. Hourly rates for upholsterers in the South were

generally lower than those in the North and West.

Furniture upholsterers receive little direct supervision. They average 40 hours a week, although they often work overtime during the weeks prior to major holidays. Many upholsterers receive paid vacations and sick leave, and some are covered by health insurance plans.

Upholstery shops are often spacious, adequately lighted, and well ventilated and heated. However, dust from padding and stuffing is sometimes present. Upholsterers stand while they work and do a considerable amount of stooping and bending. They may work from awkward positions for short periods of time. Upholstery work is generally safe, although minor cuts from sharp tools and back strain from lifting and moving heavy furniture are not uncommon.

### Where To Go for More Information

Upholsterers International Union  
of North America,  
1500 North Broad St., Philadelphia,  
Pa. 19121.

### GASOLINE SERVICE STATION ATTENDANTS

(D.O.T. 915.867)

### Nature of Work

Almost all of the more than 85 million motor vehicles in the United States are serviced at one time or another in a gasoline service station. When a car or truck is driven into a station, the service station attendant (also called gasoline station serviceman) greets the customer and inquires about his needs. The attendant may perform a variety of services for the customer, ranging from directing the customer to a street address to making a minor repair.

When servicing a car, he pumps gasoline, cleans the windshield, and, with the customer's permission, checks the water level in the radiator and battery, the oil level in the crankcase and automatic transmission, and the air pressure in the tires. He may also check the tires, fan belt, and other parts of the car for excessive wear.

The attendant also has other responsibilities besides servicing cars. He sells and installs items such as tires, batteries, fan belts, and windshield wiper blades. When a customer pays his bill, he makes change, or prepares a charge slip if the customer uses a credit card. He may also dispense trading stamps. In small stations, particularly, he may perform minor maintenance and repair work, such as lubrication, rotating tires, repairing tires, or replacing a muffler. Some attendants, called mechanic attendants, make more difficult repairs. Before and after doing maintenance and repair work, the attendant may drive the customer's car between a convenient parking place and the service area. He may also keep the service areas, building, and restrooms clean and neat. In some stations, he helps the station manager take inventory, set up displays, and perform other duties associated with the operation of a small business.

If a gasoline station provides emergency road service, the attendant



may drive a tow truck to a stalled car and change a flat tire or make other minor repairs needed to fix the customer's vehicle. If more extensive repairs are needed, he tows the vehicle back to the service station.

In doing maintenance and repair work, gasoline service station attendants may use simple handtools, such as screwdrivers, pliers, and wrenches; and power tools, such as pneumatic wrenches. Mechanic-attendants frequently use more complex equipment, such as motor analyzers and wheel alinement machines.

### Where Employed

An estimated 360,000 service station attendants were employed in gasoline service stations in early 1967. In addition to attendants, there were about 220,000 gasoline service station managers and owners who do similar work.

Gasoline service station attendants are employed in every section of the country, in the largest cities, the smallest towns, and outlying areas. About 40 percent, however, are employed in the seven States that have the largest number of motor vehicles: California, Texas, New York, Ohio, Illinois, Pennsylvania, and Michigan.

### Training, Other Qualifications, and Advancement

An applicant for a job as a gasoline service station attendant should have a driver's license, a general understanding of how an automobile works, and some sales ability. He should be friendly and able to speak well, present a generally neat appearance, and have self-confidence. He should know simple arithmetic so that he can make change quickly and accurately and help keep business records. An applicant should be familiar with local roads, highways, and points of interest in order to give directions to strangers and to locate vehicles whose owners have called for road service.

Although completion of high school is not generally a requirement for getting an entry job, it is an advantage because, to many employers, it indicates that a young man can "finish a job." A high school education is generally required in order for attendants to qualify for service station management training programs conducted by oil companies, and to advance to the position of service station manager.

Gasoline service station attendants usually are trained on the job, although there are some formal training programs. Attendants who are trained on the job are first given relatively simple work assignments. They may be required to keep the station clean, wash cars, pump gas, clean windshields, and otherwise make themselves useful. Gradually, they progress to more advanced work such as making sales, writing credit charge slips, doing simple maintenance work, installing accessories on cars, and helping to keep the station records. It usually takes from several months to a year for a gasoline service station attendant to become fully qualified.

Formal training programs for young people who want to do gasoline service station work are offered in many high schools around the country. In this curriculum, known as distributive education, students in their last 2 years of high school take business education courses and work part time in a gasoline service station where they receive instruction and supervision in all phases of service station work.

The Manpower Development and Training Act conducts training programs in a number of cities for unemployed and underemployed workers who want to become gasoline service station attendants. These programs, which lasted up to 26 weeks in early 1967, emphasize the maintenance and repair duties of the occupation.

Some attendants are enrolled in formal training programs for service station managers, which are conducted by most major oil companies. These programs usually last from 2

to 8 weeks and emphasize subjects such as simple automobile maintenance, salesmanship, and business management.

Several avenues of advancement are open to gasoline service station attendants. Additional training qualifies attendants to become automobile mechanics; those having business management capabilities may advance to station manager. Many experienced station managers and automobile mechanics go into business for themselves by leasing a station from an oil company, as is most common, or by buying their own service station. Some service station attendants and managers advance to salesmen or district managers with the oil companies.

### Employment Outlook

Employment of gasoline service station attendants is expected to increase moderately during the remainder of the 1960's and through the 1970's, creating several thousand full-time and part-time job openings annually. In this large occupation, an even greater number of job openings will result from the need to replace attendants who transfer to other fields of work, are promoted, or who retire or die. Deaths and retirements alone are expected to provide an estimated 4,000 full-time job opportunities annually.

Employment of service station attendants is expected to increase as a result of a growing consumption of gasoline and other service station products. The number of motor vehicles registered is expected to rise because of growing population, income, multiple car ownership, and the continuing movement to the suburbs. Also, greater use is expected to be made of cars as families have more leisure to visit national parks and other points of interest, and as the highway system continues to be improved.

More attendants may also be needed to perform additional maintenance on newer, more complex cars. For example, more cars will have

devices that reduce exhaust fumes, and these devices must be serviced periodically. On the other hand, more cars that require oil changes and lubrication less frequently will offset partially the servicing requirements of additional, more complex vehicles.

### Earnings and Working Conditions

Hourly earnings of gasoline service station attendants vary considerably. They are generally highest in metropolitan areas in the Western and Northeastern States. Average straight time hourly earnings of attendants across the country were approximately \$1.60 in 1966. Some attendants employed in a few large cities, however, earned \$2 or more an hour. Most full-time gasoline service station attendants had average weekly earnings of about \$85 in 1966.

In many stations, employers provide fringe benefits such as accident and health insurance and paid vacations. Some employers furnish uniforms and pay for their cleaning; others require the attendant to pay for these expenses. More than one-half of the attendants work over 40 hours a week; many work more than 48 hours. Attendants frequently work at night and on weekends and holidays.

A gasoline service station attendant works out of doors in all kinds of weather. He must be in good physical condition because he does considerable lifting and stooping and spends much time on his feet. Possible injuries include cuts from sharp tools and burns from hot engines. The attendant frequently gets dirty because he pumps gasoline, handles oil and grease, and works with greasy tools and around dirty cars. For many attendants, however, the opportunity to meet new people and the possibility of someday managing their own service stations more than offset these disadvantages. For others, the opportunity to get part-time employment is important.

Some high school and college students have been able to work their

way through school by working as gasoline service station attendants after school, and on vacations and holidays. Some workers also supplement their income from regular jobs by working part time as attendants.

### Where To Go for More Information

For further information regarding work opportunities for gasoline service station attendants, inquiries should be directed to local gasoline service stations or the local office of the State employment service. The State employment service also may be a source of information about training programs operated under provisions of the Manpower Development and Training Act.

General information about the work of gasoline service station attendants may be obtained from:

American Petroleum Institute, Marketing Division,  
1271 Avenue of the Americas, New York, N.Y. 10020.

## INSPECTORS

### (Manufacturing)

#### Nature of Work

Almost everything manufactured must be carefully inspected during the manufacturing process. The millions of automobiles, sewing machines, television sets, production machines, and other mass-produced items must be tested and inspected to make sure they operate properly. The workers who see that the size and quality of raw materials, parts, assemblies, and finished products meet specifications are known as inspectors.

Inspectors use a variety of methods in order to be certain that the products they examine conform to specifications. They may merely look for scratches and other defects in prod-

ucts or parts; or they may use gages, micrometers, and other measuring devices to check the accuracy of the parts. Semiskilled inspectors may be required to read simple work orders, and do arithmetic involving decimals and fractions when reading measuring instruments. Inspectors often keep records of the number of parts they have accepted, and rejected. When they find a large number of faulty pieces, they notify their supervisors so that corrections can be made on the production line. Some inspectors use handtools, such as screwdrivers or pliers, in their work. In some industries, inspectors may make minor repairs and adjustments, and grade products for quality.

The kinds of products that inspectors check vary widely by industry. For example, in radio and television manufacturing plants, many inspectors test tubes and circuits to see that they meet specifications. In the automobile industry, they examine raw materials and parts during the various stages of manufacturing, as well as the complete automobile.

(In addition to the semiskilled inspectors described in this statement, there are many skilled inspectors. Skilled inspectors work under general



Inspector examines negative used in making circuit boards.

supervision, whereas semiskilled inspectors usually work under close supervision. Skilled inspectors often use a much wider variety of testing instruments; and in the metalworking industries are often required to read blueprints and interpret complex specifications. They generally have greater discretion in accepting or rejecting products and usually are responsible for inspecting the most critical parts of mass-produced goods.)

### Where Employed

In early 1967, approximately 575,000 inspectors (most of whom were semiskilled) were employed in a wide variety of manufacturing industries. Most of these inspectors worked in plants producing durable goods such as electrical and nonelectrical machinery, fabricated metal products, transportation equipment, and aerospace products. Others were employed in plants producing nondurable goods such as chemicals, textiles, apparel, and food products. Large numbers of inspectors were employed in Ohio, New York, Michigan, Illinois, Pennsylvania, California, and New Jersey.

About one-half of all semiskilled inspectors were women. Many of these women were employed in the food, textile, and apparel industries. Others were employed throughout the metalworking industries, especially in plants that produce small electrical and electronic components.

### Training, Other Qualifications, and Advancement

Semiskilled inspectors generally are trained on the job for a brief period—from a few hours or days to several months, depending upon the skill required.

Many employers look for applicants who have good health and eyesight, can follow directions, and are dependable. Some employers prefer experienced production workers for

inspection jobs. A few large companies give aptitude tests in selecting new employees for inspection work. For example, in the electronics industry, new workers may be given tests to determine their ability to work with numbers. Employers also look for employees who can do work requiring constant attention. Employers may hire applicants who do not have a high school diploma, if they have qualifying aptitudes or related job experience.

Some semiskilled inspectors in the metal products industries who supplement their work experience with formal educational courses, such as blueprint reading, shop mathematics, and electrical theory, may advance to skilled inspectors. A few semiskilled inspectors, after acquiring sufficient experience and knowledge, may advance to foremen jobs.

### Employment Outlook

The employment of semiskilled inspectors is expected to increase slowly during the remainder of the 1960's and through the 1970's, creating several thousand job openings annually. In addition, a considerable number of job opportunities will result as workers retire, die, or transfer to other fields of work, and as women leave their jobs to marry or rear a family. Deaths and retirements alone will account for about 15,000 openings each year.

Most of the industries that employ these workers, especially the electrical machinery industry, are expected to increase their employment in the long run. The growing complexity of the products manufactured in our factories, and rising quality standards, should also result in a need for more inspectors. These factors will be partially offset, however, by the increasing use of mechanized and automatic inspection equipment.

### Earnings and Working Conditions

Inspectors' earnings vary considerably depending on their skill, the type

of product inspected, the method of wage payment, and the size and location of the plant in which they are employed. Inspector jobs are commonly classified as A, B, and C, to reflect the level of skill and responsibility involved. (For the purpose of this publication, class B and C inspectors are considered to be semiskilled workers.) The following tabulation presents average straight-time hourly earnings of class B and C inspectors in the nonelectrical machinery industry:

*Average straight-time hourly earnings of class B and C inspectors in nonelectrical machinery, mid-1966*

Area	Class B	Class C
United States <sup>1</sup> . . . . .	\$2.87	\$2.44
New England . . . . .	2.76	2.23
Middle Atlantic . . . . .	2.82	2.39
Border States . . . . .	2.77	2.24
Southeast . . . . .	2.13	1.77
Southwest . . . . .	2.65	2.09
Great Lakes . . . . .	2.99	2.65
Middle West . . . . .	2.80	2.48
Pacific . . . . .	2.80	2.51

<sup>1</sup>Includes data for Mountain States.

The working conditions of inspectors also vary considerably. For example, some may work in well-lighted air-conditioned workplaces in an aircraft or missile plant; others, who may work on the production floor of a machinery or metal fabricating plant, often are exposed to high temperatures, oil, grease, and noise.

Many inspectors employed in manufacturing industries are members of labor unions. The International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers are among the large unions to which these workers belong. Most of the labor-management contracts in manufacturing plants employing inspectors provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

## JEWELERS AND JEWELRY REPAIRMEN

(D.O.T. 700.281 and .381)

### Nature of Work

Jewelers make rings, pins, necklaces, bracelets, and other precious jewelry by hand. They create jewelry by setting precious or semiprecious jewels in metal such as gold, silver, and platinum; or by using these metals only. These skilled craftsmen also repair jewelry. For example, they solder broken parts, make new parts, enlarge or reduce the size of rings, reset stones, and restyle old jewelry. The jewelers' work is very delicate and must be done with care and precision, as the materials used are usually extremely expensive. An eye "loupe," or magnifying glass held over the eye, is often necessary.

In making jewelry, jewelers may follow their own design or one prepared by a design specialist. The metal is formed to follow the design in several ways. Special-order work may involve shaping metal stock with hand and machine tools or melting and casting metal in a mold. When jewelry is produced in volume, the metal usually is formed either by the casting or the stamping process.

Shaping metal stock by hand may involve the following metalworking operations: outlining, cutting, drilling, sawing, filing, shaping, engraving, and electroplating. Individual parts are polished and then joined by soldering. After the article has been assembled, surface decorations are made and jewels or stones are mounted. When jewelry is made in this manner, tools such as files, saws, drills, dapping, carving, and chasing tools; jewelers' lathes; soldering irons; and polishing machines are used.

To cast gold and platinum jewelry, a model of the piece is made by a jewelry modelmaker, a craftsman who has a thorough knowledge of the casting process. A rubber mold is pro-



Jeweler uses hand soldering torch to assemble sterling silver jewelry.

duced from the model, and into this mold wax or plastic is injected under pressure. The pattern so produced is placed in a plasterlike material and burned out, leaving a cavity in the material. The precious metal is then cast into this cavity by centrifugal pressure. After cooling, the cast piece is removed. Articles produced by this process require a minimum of finishing. Jewels or stones may then be set in the cast piece and it may be engraved.

Cast costume jewelry is similarly produced, except that the metal is cast directly into a rubber or metal mold, after which it is either tumbled and plated or finished on a polishing machine.

In the stamping process, which is used to make costume and some precious jewelry, the metal piece is formed in a stamping machine that brings together, under tremendous force, a die and the metal from which the piece is to be made. The die has a cavity shaped to the exact contour and dimension of the desired article.

As a rule, jewelers specialize in making a particular kind of jewelry, or in a particular operation, such as making models and tools, engraving, polishing, or setting diamonds and other stones. After years of experience, some may become all-round

jewelers, capable of making and repairing any kind of jewelry. Costume jewelry and some kinds of precious jewelry are mass produced by factory workers using assembly line methods. However, highly skilled jewelers are needed to make the models and tools for this large-scale production. They also may perform some finishing operations, such as stone setting and engraving, on stamped or cast pieces.

Many jewelers make and repair jewelry in their own stores where they sell jewelry, watches, and, often, other merchandise, such as silverware, china, and glassware. They may also do watch repairing. Other jewelers operate trade shops that specialize in making jewelry and in doing repair work for those jewelry stores owned or operated by merchants who are not jewelry craftsmen or who take in more repair work than they can handle in their own stores.

### Where Employed

More than 25,000 jewelers and jewelry repairmen were employed in early 1967; over half of this number worked for themselves. Almost all of those who were self-employed owned either retail jewelry stores or trade shops that specialize in jewelry repair for retail stores. About half of those who were employed by someone else worked in jewelry manufacturing establishments. Others (about 4,000) worked in retail jewelry stores.

The Nation's 21,000 retail jewelry stores are located throughout the country. The heaviest concentration of these stores, as well as the thousands of small trade shops that service them, is in large commercial and industrial centers, such as New York City, Chicago, Los Angeles, and San Francisco.

Nearly three-fourths of all precious jewelry manufacturing plants are in New York, New Jersey, Rhode Island, and California. The center of precious jewelry manufacturing is the New York City metropolitan area.

### Training, Other Qualifications, and Advancement

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 given in several trade schools. Other trade schools offer courses in specific types of jewelry work, such as diamond setting, jewelry design, and engraving.

Formal apprenticeship in this trade takes from 3 to 4 years, depending on the type of training. For example, 3 years are required to become a colored-stone setter and 4 years to qualify as a diamond setter. Throughout the apprenticeship, training on the job is supplemented by trade school instruction in design, quality of precious stones, chemistry of metals, and other related subjects. First work assignments may be to set up work for soldering or to do simple soldering or rough polishing. As an apprentice gains experience, he advances to more difficult work. After completion of the apprenticeship, he becomes a fully qualified journeyman jeweler.

A 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, and good eyesight. Artistic ability is necessary for work in jewelry design. For those planning to become retail jewelers or to open trade shops or manufacturing establishments, the ability to deal with people and manage a business is also a necessity. Because people in this trade work with precious stones and metals they must be bonded.

Bonding requires an investigation of

one's personal background for such traits as honesty, trustworthiness, and respect for the law.

Jewelry manufacturing establishments in the major production centers offer the best opportunities for a young person to acquire all-round skills, even though the number of trainees accepted is small. Trade shops also offer some training opportunities, but their small-size—many are one- or two-man shops—limits the number of trainees.

Jewelry workers may advance in several ways. In manufacturing, for example, they can advance from production jewelers to shop foremen. In retail stores, jewelers may become heads of sales departments or store managers. Those craftsmen employed in jewelry making and repair departments operated by large retail establishments may advance to department managers. Some jewelry workers establish their own retail stores or trade shops.

A substantial financial investment is required to open a retail jewelry store and the field is highly competitive in most parts of the country. Young jewelers interested in going into business for themselves will find it advantageous to work first in an established retail jewelry store, trade shop, or jewelry manufacturing plant. Persons planning to open their own jewelry stores should have experience in selling jewelry. Those craftsmen who can also repair watches will have an advantage over those who can work on jewelry only, since watch repair work is a substantial part of the business in small jewelry stores. Talented and experienced jewelers of recognized integrity can establish their own trade shops or small manufacturing shops with a more moderate financial investment. The location of such shops would be limited to areas which have a large volume of jewelry business. For manufacturing, this means the major production centers. Trade shops have best chances for success in the moderate size or large cities where there are many retail jewelry stores.

### Employment Outlook

Employment requirements for jewelers and jewelry repairmen are expected to show little or no change in the remainder of the 1960's and throughout the 1970's. However, more than 500 job openings will arise annually because of retirements and deaths among experienced workers. Most of these job openings are expected to be filled by people trained in only one or two specialties of the trade such as stone setting, engraving, modelmaking, casting, or polishing. Nevertheless, all-round jewelers will continue to be in demand because they have been in short supply in recent years.

Rising levels of personal incomes are expected to result in a substantial increase in the demand for precious and costume jewelry, raising employment requirements for jewelers and jewelry repairmen. In addition, an increase in family formations will also raise requirements for these workers since it will spur demand for engagement and wedding rings. However, the employment effect of an increased demand for jewelry on employment requirements will be offset by more efficient means of producing and repairing jewelry.

The need for jewelry craftsmen over the period is expected to differ by place of employment. In jewelry manufacturing, most job openings will be filled by specialized craftsmen as mass-production techniques are increasingly adopted. In trade shops, where a large volume of repair work permits job specialization, job openings will also be filled mainly by specialized craftsmen. In retail jewelry stores, however, there will be job opportunities for both all-round jewelers and specialized craftsmen.

### Earnings and Working Conditions

Beginning pay for jewelry repairmen employed in retail stores and trade shops ranged from \$75 to \$85 a week in early 1967; experienced workers in these establishments earn-



ed up to \$225 weekly. Wages were highest for jewelry repairmen who worked in large metropolitan areas. Jewelers who own retail stores or trade shops earn considerably more than jewelers working as employees in such establishments.

One union-management agreement, covering about 2,000 jewelry workers employed in plants manufac-

turing precious jewelry in New York City, provides the minimum hourly rates shown in the following tabulation for inexperienced workers (including apprentices) and for journeymen in selected crafts, as of February 1, 1967 and 1968. Average hourly earnings for journeymen covered by this agreement in February 1967 are also shown in the tabulation.

Occupation	Average hourly earnings, February 1967	Minimum hourly job rates	
		February 1967	February 1968
Starting rate—all inexperienced workers.....		\$1. 58	\$1. 66
Journeyman's rate:			
Production jewelers.....	\$3. 46	2. 70	2. 80
Jewelers—handmade work.....	4. 03	3. 20	3. 30
Modelmakers.....	4. 67	3. 25	3. 35
Stone setting:			
Diamond.....	4. 24	3. 20	3. 30
Colored stones.....	3. 34	2. 90	3. 00
Handmade work.....		3. 45	3. 55
Chasers.....	3. 81	2. 70	2. 80
Engravers.....	3. 45	2. 70	2. 80
Polishers.....	3. 07	2. 70	2. 80
Casters.....	3. 37	2. 50	2. 60

Under this agreement, all inexperienced workers, including apprentices, receive increases of 10 cents an hour every 3 months until they reach the minimum journeyman rate for their particular job, which is considerably lower than average hourly earnings in the trades.

Skilled workers in the precious jewelry manufacturing union shops in 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. Retail jewelers and jewelry repairmen work 40 to 48 hours a week, and may work longer hours during the holiday seasons.

### Where To Go for More Information

Information on employment opportunities for jewelers and jewelry repairmen in retail jewelry stores may be obtained from:

Retail Jewelers of America, Inc.,  
1025 Vermont Ave. NW., Wash-  
ington, D.C. 20005.

Information on employment opportunities in manufacturing establishments may be obtained from:

Manufacturing Jewelers and Silversmiths of America, Inc.,  
Sheraton-Biltmore Hotel, Room S-75,  
Providence, R.I. 02902.

International Jewelry Workers'  
Union, Local No. 1,  
133 West 44th St., New York, N.Y.  
10036.

## MOTION PICTURE PROJECTIONIST

(D.O.T. 960.382)

### Nature of Work

The projectionist is an important man behind the scenes in the motion picture theater. From an elevated room at the back of the theater, he operates the projection machines and audio equipment, assuring high

quality screen and sound presentation for the audience.

In showing a feature length movie, the projectionist uses two projectors, audio equipment, a film rewinding machine, and seven reels or more of film. Before the first feature is scheduled to begin, he checks the equipment to see that it operates properly and loads the two projectors with the first and second reels to be shown. To load a projector he threads the film through a series of sprockets and guide rollers, and attaches it to a take-up reel. Most projectors burn a carbon rod to provide light for the screen. After igniting and adjusting the carbon rod, the projectionist starts the projector containing the first reel. When the reel has reached proper running speed, he opens a shutter and the picture appears on the screen. If the picture is out of focus or unsteady, he makes the necessary adjustments on the projector.

A film reel lasts approximately 20 minutes. When the first reel is near completion, the projectionist watches for cue marks (small circles in the upper right hand corner of the screen) which indicate that it is time to start the second projector. When a second series of cue marks appears, he simultaneously closes the shutter on the first projector and opens the shutter on the second projector. This changeover happens so quickly that the viewer in the audience does not notice an interruption on the screen. Next, the projectionist removes the used reel, and rewinds it on the rewinding machine. The projectionist repeats the process described above until all the reels have been used. If the film breaks, the projectionist must work rapidly to rethread it so that the show may continue.

In addition to operating the equipment, the projectionist cleans and lubricates it, checks for defective parts and damaged film, and makes minor repairs and adjustments. By keeping his equipment in good operating condition, the projectionist reduces the possibility of malfunctions and breakdowns. For example,



he may replace a badly worn projector sprocket which could eventually cause film damage or an unsteady picture. Major repairs are made by servicemen who specialize in projection and audio equipment.

### Where Employed

An estimated 15,500 full-time motion picture projectionists—nearly all of them males—were employed in early 1966. More than three-fourths of them were employed in indoor theaters; most of the remainder were employed in drive-in theaters. Other employers of projectionists included

large manufacturers, television studios, and Federal, State, and local governments. Most theaters employ one projectionist per shift; few employ more than two.

Projectionists work in cities and towns of all sizes throughout the country. In a theater located in a small town, the theater owner or a member of his family may perform the duties of the projectionist.

### Training, Other Qualifications, and Advancement

Most motion picture theaters in urban areas are unionized, and

young people who aspire to work as motion picture projectionists in these theaters must complete a period of apprenticeship. Apprenticeship applicants must be at least 18 years of age, and high school graduates are usually preferred.

The length of time a person must serve as an apprentice before taking an examination for union membership may vary from 1 to 2 years, depending on the policies of union locals. However, if he is capable of performing the work, an apprentice may be assigned to a full- or part-time job at journeyman's pay before becoming a member. In a few cities and States, projectionists must be licensed.

An apprentice learns the trade by working full- or part-time with experienced projectionists. He first learns simple tasks such as threading and rewinding film, and, as he gains experience, progresses to more difficult assignments such as adjusting and repairing equipment. He may work in several theaters to become familiar with different types of equipment. Many apprentices receive no pay while being trained. In a non-union theater, a young man may start as an usher or helper and learn the trade by working with an experienced projectionist.

Young men interested in becoming projectionists should have good eyesight, including normal color perception and good hearing. They should be temperamentally suited to working alone in close quarters. Manual dexterity and mechanical aptitude are also important personal qualifications. Practical experience gained from operating small movie projectors at home, at school, or in the Armed Forces is also helpful. High school courses in science may help a young man to better understand the theories of motion picture projection and sound amplification.

### Employment Outlook

Although a small increase in employment of motion picture projectionists is expected during the next

decade, most job opportunities will arise as experienced workers retire, die, or transfer to other fields of work. Retirements and deaths alone may result in more than 400 job openings annually, but competition for the available openings is likely to continue to be keen. Some of these openings will be filled by experienced projectionists who are unemployed or underemployed.

Employment of projectionists is closely related to the number of motion picture theaters. Following a rapid decline in the 1950's and early 1960's, the number of theaters has leveled off in recent years but is expected to increase slightly during the next decade. Among the factors which may contribute to this increase are the growing population, rising personal incomes, increased leisure time, and the continued movement of people to suburban areas.

### Earnings and Working Conditions

Motion picture projectionists had average straight-time hourly earnings of \$2.91, based on a national survey of motion picture theaters in early 1966. Among the 17 metropolitan areas included in the survey, average hourly earnings of these workers ranged from \$2.18 in Baltimore, Md. to \$5.01 in New York, N.Y. As a rule, downtown theaters pay higher hourly rates than suburban or drive-in theaters.

Most projectionists work evenings. Generally, those employed on a full-time basis work 4 to 6 hours, 6 evenings per week. They may work more than 6 hours on Saturday in a theater which features Saturday matinees. Some projectionists work at several theaters. For example, a projectionist's weekly schedule may call for 2 evenings in each of three theaters. Projectionists employed in drive-in theaters, particularly those in Northern States, may be laid off for several months during the winter.

Many projectionists receive 2 or 3 weeks of paid vacation and premium pay for weekend or holiday work.

Some projectionists are covered by hospitalization and pension plans.

The motion picture projectionist works in a room called a projection booth. In most theaters, these booths have adequate lighting, ventilation, and work space. Many booths are air conditioned. The work is relatively free of hazards, but there is danger of electrical shocks and burns if proper safety precautions are not taken. The motion picture projectionist's work is not physically strenuous. He frequently lifts and handles film reels, but most of these weigh no more than 35 pounds. Although he must be on his feet much of the time, he can sit for short periods while the equipment is in operation. Most projectionists work without direct supervision and have infrequent contact with other theater employees.

### Where To Go for More Information

Further information about apprenticeship programs and employment opportunities may be obtained from any local union of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada.

## PHOTOGRAPHIC LABORATORY OCCUPATIONS

(D.O.T. 970.281; and 976.381, .687, .782, .684, .855, .886, and .887)

### Nature of Work

The rising popularity of amateur photography and increasing demand for professional photographic services are creating many job opportunities for photographic laboratory workers. These workers develop film, make prints and slides, and perform related tasks such as enlarging photographs. (This chapter does not discuss employees of laboratories that specialize

in processing professional motion picture film.)

*All-round darkroom technicians* (D.O.T. 976.381) are capable of performing all of the tasks involved in developing and printing film. Although these workers may use some mechanized processing equipment, they rely chiefly on manual methods. The darkroom technician develops film in tanks and trays containing chemical solutions. He varies the developing process according to the type of film—black and white negative, color negative, or color positive. For example, a developing process for black and white negative film covers five steps: developer, stop bath, fixing bath, washing, and drying. The first three steps are performed in darkness. After unwinding a roll of film, the darkroom technician places it in the developer, a chemical solution which brings out the image on exposed film. After the film has remained in the developer for a specified period of time, the darkroom technician transfers it to a stop bath to prevent overdevelopment. Next, he places the film in a fixing bath which makes it insensitive to light, thus preventing further exposure. He then washes the film to remove the fixing solution and places it in a drying cabinet. If a developed negative has flaws, such as scratches and bare spots, the darkroom technician may retouch these areas using an ink-like substance. Developing processes for color negative and color positive films are more complex than those used for black and white negative film. Thus, some laboratories employ *color technicians* (D.O.T. 976.381)—highly skilled workers who specialize in processing color film.

The darkroom technician makes a photograph by transferring the image from a negative to photographic paper. Printing is frequently performed on a projection printer, which consists of a fixture for holding negatives and photographic paper, an electric lamp, and a magnifying lens. The darkroom technician places the negative between the lamp and lens, and



Darkroom technician examines finished print.

the paper below the lens. When he turns the lamp on, the light passes through the negative and lens, and records a magnified image of the negative on the paper. During printing, the darkroom technician may vary the contrast of the image or remove unwanted background by using his hand or paper patterns to shade parts of the photographic paper from the lamp light. After removing the exposed photographic paper from the printer, he develops it in much the same way as the negative. If the customer desires, the darkroom technician mounts the finished print in a frame or on a paper or cardboard back, using cement or a hand-operated press.

In addition to working in the laboratory, darkroom technicians may

set up lights and cameras or otherwise assist experienced photographers. Many darkroom technicians, particularly those employed in portrait studios, divide their time between taking pictures and processing them. In some laboratories, helpers assist darkroom technicians. They also may be assisted by workers who specialize in a particular activity, such as *developers* (D.O.T. 976.381), *printers* (D.O.T. 976.381), and *photograph retouchers* (D.O.T. 970.281).

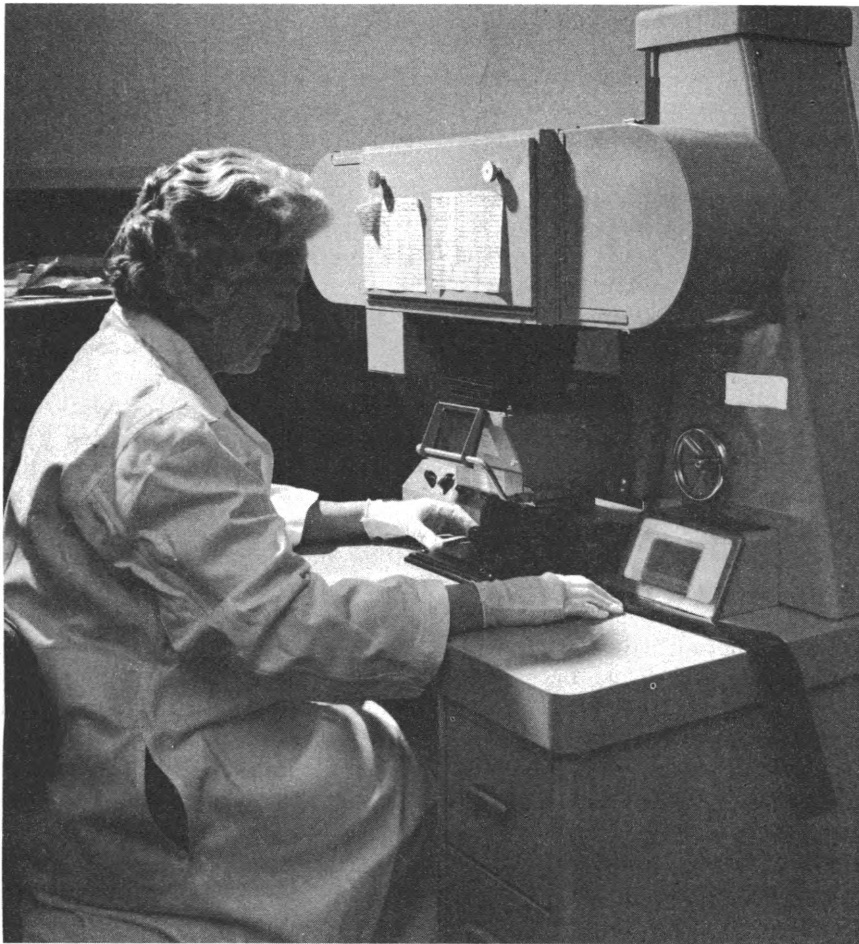
In large mechanized photographic laboratories, darkroom technicians may be employed to supervise workers in semiskilled occupations. Most of these workers perform specialized assignments which require only a limited knowledge of developing and printing processes. Included in this

group are *film numberers* (D.O.T. 976.887), who sort film according to the type of processing needed and number each roll for identification purposes; *film strippers* (D.O.T. 976.887), who unwind rolls of film and place them in developing machines; *printer operators* (D.O.T. 976.782), who operate machines which expose rolls of photographic paper to negatives; *print developers, machine* (D.O.T. 976.885), who operate machines which develop these rolls of exposed photographic paper; *chemical mixers* (D.O.T. 976.884), who measure and combine the various chemicals which make up developing solutions; *slide mounters* (D.O.T. 976.885) who operate machines which cut, insert, and seal film in cardboard mounts; and *photocheckers and assemblers* (D.O.T. 976.687), who inspect the finished slides and prints and package them for return to customers.

### Where Employed

In early 1967, an estimated 30,000 workers were employed in photographic laboratory occupations. Almost half of them were darkroom technicians; the remainder were in semiskilled photofinishing occupations. Most darkroom technicians are men. Women predominate in many of the semiskilled occupations. For example, most printer operators, slide mounters, and photocheckers and assemblers are women.

A large proportion of the darkroom technicians are employed in photographic laboratories operated by portrait and commercial studios and by business and government organizations. The latter include manufacturers, newspaper and magazine publishers, advertising agencies, and Federal, State, and local governments. Darkroom technicians are also employed in small commercial laboratories that specialize in processing the work of free-lance photographers, advertising agencies, magazine publishers, and others. Most of the



Printer operator makes photographs from negatives.

workers in semiskilled occupations are employed by large commercial photographic laboratories that specialize in processing film for amateur photographers.

### Training, Other Qualifications, and Advancement

Most darkroom technicians learn their skills through informal, on-the-job training. Beginners start as helpers and gradually learn to develop and print film by assisting experienced technicians. It generally takes 3 or 4 years to become a fully qualified darkroom technician. Some helpers become specialists in a particular activity, such as printing or developing. Generally, the training time required to become a specialist is less

than is needed to become an all-round darkroom technician.

Employers prefer to hire darkroom technicians' helpers who have a high school education. Courses in chemistry, physics, and mathematics are helpful to young people who are interested in this trade. Some high schools and trade schools offer courses in photography which include training in film processing. Experience gained through processing film as a hobby is also helpful. Some darkroom technicians have received training and experience in the Armed Forces.

Two-year curriculums leading to an associate degree in photographic technology are offered by a few colleges. The completion of college level courses in this field is helpful to young people aspiring to supervisory and

managerial jobs in photographic laboratories.

Many darkroom technicians eventually become professional photographers. Others advance to supervisory positions in laboratories. Darkroom technicians who have gained experience in small laboratories need additional training before they can qualify for supervisory positions in large laboratories where mechanized equipment is used.

Training requirements for workers in semiskilled occupations range from a few weeks to several months of on-the-job training. For example, film numberers and slide mounters can usually learn their jobs in less than a month, but printer operators and chemical mixers need several months or longer to learn their jobs. For many of the semiskilled jobs, manual dexterity, good vision including normal color perception, and good eye-hand coordination are important qualifications. However, some laboratories employ blind workers as film numberers and film strippers, since these jobs may be performed in the dark to prevent damage to exposed film. Completion of high school is not generally a requirement for semiskilled jobs, but it is frequently needed for advancement to supervisory jobs.

### Employment Outlook

Employment in photographic laboratory occupations is expected to increase moderately during the remainder of this decade and throughout the 1970's. Most of the job opportunities, however, will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Retirements and deaths alone will create an estimated 800 job openings annually.

The need for semiskilled workers is closely tied to the growth of amateur photography. Film purchases by amateur photographers are expected to increase rapidly during the next decade as a result of rising population and personal income, more leisure time, and increased travel. Improve-

ments in still and movie cameras, which make them easier to load, unload, and operate, should also contribute to increases in the purchase of film. However, the more widespread use of mechanized film processing equipment and improvements in this type of equipment will tend to increase the efficiency of laboratory workers, thus keeping employment from growing as fast as the volume of film processed.

The need for all-round darkroom technicians is expected to increase as a result of the growing demand for photography in business and government. A major factor contributing to this demand will be the increasing variety of printed matter such as sales brochures, catalogues, and public relations literature, which is illustrated extensively with photographs. The growing use of photography in research and development activities will also contribute to the demand for darkroom technicians. However, the generally favorable employment effects of these factors will be partially offset by greater use of mechanized film processing equipment in small laboratories.

### Earnings and Working Conditions

Information obtained from several employers in late 1966 indicate that earnings of workers in photographic laboratory occupations vary greatly, depending on factors such as skill level, experience, and geographic location. Beginning pay for inexperienced darkroom technician's helpers generally ranged from \$1.50 to \$2.25 an hour. Most of the experienced all-round darkroom technicians earned between \$2.50 and \$5.00 an hour. In addition to all-round darkroom technicians, color technicians and printers generally had the highest earnings.

Workers in semiskilled occupations earned from \$1.25 to \$3.40 an hour. Among these workers, printer operators and chemical mixers generally had the highest earnings.

Many photographic laboratories provide paid holidays, vacations, and

other benefits such as medical-surgical insurance. Workers in photofinishing laboratories operated by business and government organizations receive the same fringe benefits as their fellow employees.

The majority of photographic laboratory employees have a standard workweek of 40 hours and receive premium pay for overtime. In laboratories that specialize in processing film for amateur photographers, employees may work a considerable amount of overtime during the summer and for several weeks after Christmas. Many laboratories employ additional workers temporarily during these seasonal peaks.

Most photographic laboratory jobs are not physically strenuous. In many semiskilled occupations, workers perform their jobs while sitting, but the work is repetitious and the pace is rapid. Some of these workers (for example, printer operators and photocheckers and assemblers) are subject to eye fatigue. Photofinishing laboratories are generally clean, well lighted, and air conditioned.

### Where To Go for More Information

Additional information about employment opportunities in photographic laboratories and schools which offer degrees in photographic technology may be obtained from:

Master Photo Dealers' and Finishers' Association,  
603 Lansing Ave., Jackson, Mich.  
49202.

### POWER TRUCK OPERATORS

(D.O.T. 892.883; 921.782 and .883; and 922.782 and .883)

#### Nature of Work

In the past, manual workers in factories usually did the hard physical labor of moving raw materials and

products. Today, many heavy materials are moved, with little physical effort by workers who operate various types of self-powered trucks, which can easily carry tons of material and lift it to heights of many feet.

A typical truck operated by these workers has a hydraulic or electric lifting mechanism with attachments such as forks to lift piles of cartons or other containers, and scoops to lift coal or other loose material. Some power trucks are equipped with tow bars used to pull small trailers.

Power truck operators start the truck, make it go forward or backward, stop the truck, and control the lifting mechanism and attachments by moving pedals and/or levers. Power truck operators may be required to keep records of materials moved, do some manual loading and unloading of materials, and maintain their trucks in good working condition by cleaning, oiling, checking water in batteries, and making simple adjustments.

The driver must use care and skill in driving his truck. For example, in driving through aisles where materials are stored or when loading or removing materials from stock, which may be stacked from floor to ceiling, he must be able to judge distance so that no damage occurs. The operator also must know how much the truck can lift and carry and the kinds of jobs it can do.

### Where Employed

In 1967, more than 90,000 power truck operators were employed in manufacturing plants throughout the country. Almost half of these operators worked in the North Central States. Although semiskilled power truck operators were employed in all types of manufacturing industries, many were employed in metalworking plants that manufactured automobiles and automobile parts, machinery, fabricated metal products, and iron and steel. In addition to working in factories, large numbers



Many power truck operators are employed in warehouses.

of power truck operators were employed in warehouses, depots, dock terminals, mines, and other places where great quantities of materials must be moved.

**Training, Other Qualifications, and Advancement**

Most workers can learn to operate a power truck in a few days. It takes several weeks, however, to learn the

physical layout and operation of a plant or other establishment and the most efficient way of handling the materials to be moved.

Large companies generally require applicants for a power truck operator job to pass a physical examination. Many large companies also have formal training programs for new employees. In these training programs, the employee learns to operate the power truck, to do simple maintenance work, principles of loading and

handling materials, plant layout and plant operation, and safe driving practices and rules.

There are some opportunities for advancement. A few operators may become materials movement foremen or supervisors.

**Employment Outlook**

Employment of power truck operators is expected to increase moderately during the remainder of the 1960's and through the 1970's. Replacement needs resulting from retirements, deaths, and transfers to other jobs also will provide many job openings.

Employment of power truck operators is expected to increase because of the need to move the increasingly huge amounts of manufactured goods demanded by the Nation's growing population and rising standard of living. Most of the industries which employ large numbers of these workers are expected to have a long-range upward trend in employment. In addition, the increasing use of containers and pallets for moving goods will increase the need for power truck operators. The favorable effects of these two factors on employment, however, will be partially offset by improved plant design and the continued development of more efficient power trucks and other mechanized materials-handling equipment.

**Earnings and Working Conditions**

Power truck operators employed in manufacturing industries generally are paid an hourly rate. The following table presents average straight-time hourly earnings for such workers:

*Average straight-time hourly earnings of power truck operators in manufacturing, 1966*

Area	Hourly rate
United States	\$2.69
Northeast	2.67
South	2.33
North Central	2.78
West	2.86

Power truck operators are subject to several hazards—such as falling objects and collisions between vehicles. Safety instruction is therefore an important part of the job training in power trucking work.

The driver may operate his truck inside buildings, or outdoors where he is exposed to various weather conditions. Some operators may handle loose material that may be dirty or dusty.

Power truck operators have somewhat varied work in moving materials throughout a plant. Their work is likely to be less repetitive and routine than that of workers who do semi-skilled machine operator work.

Many power truck operators are members of labor unions. Most labor-management contracts in manufacturing plants employing power truck operators provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

## PRODUCTION PAINTERS

### Nature of Work

Almost every metal or wood product manufactured by American industry is given a coating of paint or other protective material. In mass-production industries this painting is done by workers known as production painters. Most of these workers use spray guns to apply paint, lacquer, varnish, or other finishes to parts or finished manufactured products. Some production painters use brushes to apply paint and others operate semiautomatic paint spraying machines, dipping tanks, or tumbling barrels. The work done by production painters in factories is different from that performed by skilled painters who are employed in construction and maintenance work. (See statement on Painters.)

Production painters who operate spray guns pour paints into a spray gun container that is attached to an air-compressor unit. They adjust the nozzle of the spray gun and the air-compressor so that the paint will be applied uniformly. The objects being sprayed may be stationary or attached to a moving conveyor. Production painters who operate semiautomatic painting machines may load items into the machine or onto conveyors before applying paint. When working on objects requiring more than one color, production painters may apply masking tape to prevent overlapping of colors.

Although the duties of most production painters are simple and repetitive, the jobs of some may be varied. These production painters may make decisions involving the application of finishes, thinning of paint, and the adjustment of paint spray equipment. Production painters also may clean the surface to be painted before painting. When production painters are required to mix paints and figure the size of the area to be painted, they use simple arithmetic involving decimals and fractions. Production painters may replace nozzles and clean guns and other paint equipment when necessary. Some production painters may operate specialized spray guns such as those operated at high temperatures and used to spray powdered plastics. In addition to their painting equipment, production painters use tools such as mixing paddles, pliers, wrenches, rules, and gages that indicate the consistency of liquid paint.

### Where Employed

About 150,000 production painters were employed in manufacturing industries in early 1967—approximately 1 of every 8 was a woman. Over three-fourths of all production painters were in industries making durable items such as automobiles, refrigerators, furniture, electrical measuring meters, and transformers. About half of all production painters were em-

ployed in New York, Michigan, Ohio, California, Illinois, Pennsylvania, Indiana, North Carolina, and New Jersey.

### Training, Other Qualifications, and Advancement

Most production painters learn their jobs through on-the-job training. The length of training may vary from 2 weeks to several months.

The new worker may have his job duties explained to him by his supervisor and then work under the guidance of an experienced employee. The trainee may observe the experienced employee at work or assist him in his work.

A person going into this work should be in good health, be able to stand for long periods of time, have a steady hand, and have good eyesight so that he can distinguish between colors and see whether the paint is applied evenly. High school graduation is not generally required of applicants for these jobs.

There are some opportunities for advancement in this field of work. A small number of workers have become inspectors or foremen.

### Employment Outlook

Employment of production painters is expected to show little or no change during the remainder of the 1960's and through the 1970's. However, several thousand job opportunities are expected to arise annually as workers retire, die, or transfer to other lines of work. Deaths and retirements alone will result in almost 3,000 openings each year.

Employment of production painters is expected to remain relatively stable primarily because of the increasing development and use of mechanized and automatic painting equipment. For example, even though the number of automobiles produced is expected to increase substantially, the greater use of automatic sprayers will



very likely offset any need for additional production painters.

### Earnings and Working Conditions

Production painters generally are paid on an hourly basis. An examination of selected 1966 labor-management contracts in the machinery industries indicates that production painters earned from about \$2 to \$3 an hour.

Production painters are exposed to fumes from paint and paint-mixing ingredients. Some painters wear protective goggles and masks which cover the nose and mouth. When working on large objects, they may work in awkward and cramped positions.

Many production painters are members of unions. Among the labor organizations to which they belong are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Furniture Workers of America; and the United Steelworkers of America. Many labor-management contracts in the plants in which these workers are employed provide for fringe benefits such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

## SHOE REPAIRMEN

(D.O.T. 365.381)

### Nature of Work

Shoe repairmen repair worn heels and soles, broken straps, and torn seams of all types of shoes. These craftsmen also restyle shoes by attaching ornaments such as buckles and bows. Highly skilled shoe repairmen may design, make, or repair orthopedic shoes in accordance with the prescription of orthopedists and podiatrists. They also may mend handbags, luggage, tents, boat covers, and

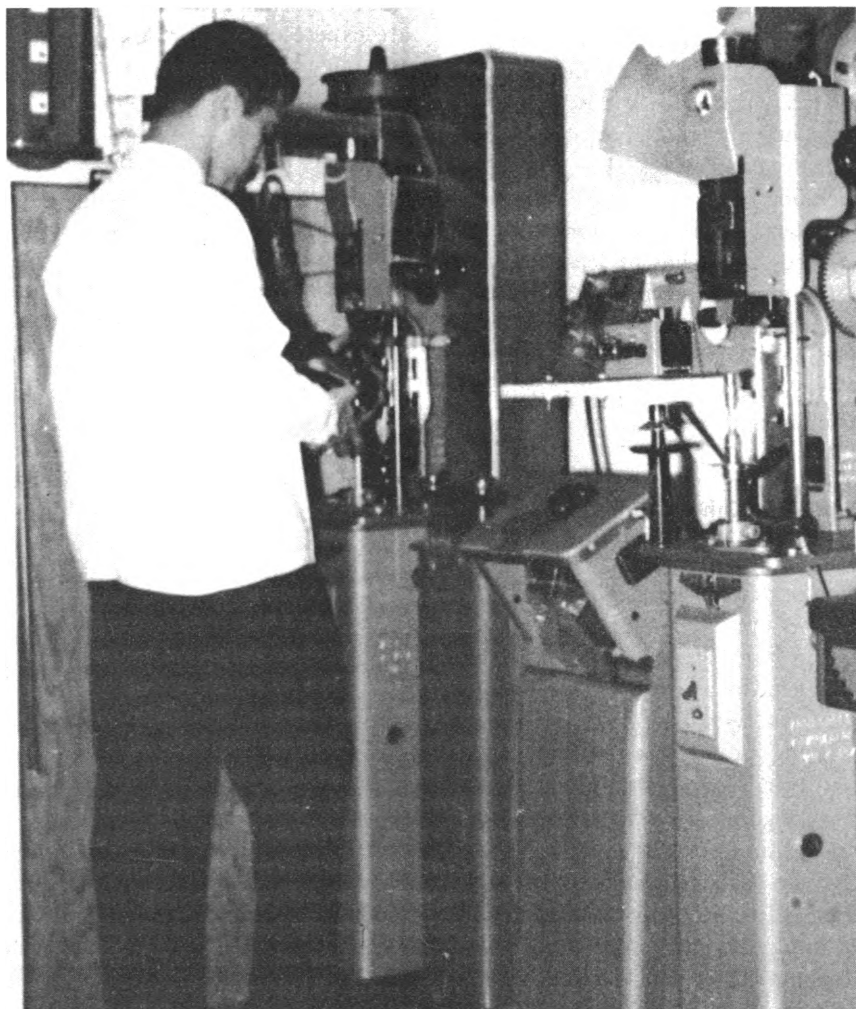
other consumer items made of leather, rubber, or canvas.

The most frequent tasks performed by shoe repairmen are replacing worn heels and soles. To resole a shoe, the repairman prepares the shoe by removing the worn sole and old stitching, and roughing the bottom of the shoe on a sanding wheel. Next, he selects a new sole or cuts one from a piece of leather and cements, nails, or sews it to the shoe. Finally, he trims the sole. To reheel a shoe, the repairman first pries off the old heel. He then selects a replacement heel or cuts one to the required shape, and cements and nails the new heel in place. The heel is then trimmed. After the heels and soles have been replaced, the shoe repairman stains and buffs

them so that they match the color of the shoes. Sometimes he cements leather tips or nails metal heel and toe plates to the new heels and soles to increase their durability. Before completing the job, the repairman may replace the insoles, restitch any loose seams, and polish and buff the shoes.

In large shops, shoe repair work often is divided into a number of specialized tasks. For example, some shoe repairmen may remove and replace heels and soles only; others only restitch torn seams.

Shoe repairmen use handtools and power and manually operated machines in their work. For example, they may use power operated sole stitchers and heel nailing machines, and manually operated sewing ma-



Repairmen use many different power and manually operated tools to repair footwear.

chines, cement presses, and shoe stretchers. Among the handtools they use are hammers, awls, and nippers.

Self-employed shoe repairmen have managerial, sales, and other responsibilities in addition to their regular duties. They make estimates of repair costs, prepare sales slips, keep records, and receive payments for work performed. They also may supervise the work of other repairmen.

### Where Employed

Over 60 percent of the estimated 32,000 shoe repairmen employed in early 1967 were proprietors of small, one-man shoe repair shops. Most of the remaining craftsmen were employed in large shoe repair establishments. Many of these large shops offered cleaning and laundering services in addition to shoe repairing. A few shoe repairmen worked in shoe repair departments of department stores, variety chain stores, shoe stores, and cleaning establishments.

Almost every community in the United States has at least one shoe repairman. However, most repairmen work in urban areas. States with large numbers of shoe repairmen include New York, California, Pennsylvania, Illinois, and Texas.

### Training, Other Qualifications, and Advancement

Most shoe repairmen are hired as helpers and receive on-the-job training in large shoe repair shops. Helpers begin by assisting experienced repairmen with simple tasks, such as staining, brushing, and shining shoes, and progress to more difficult duties as they gain experience. Helpers with an aptitude for the work and initiative can become qualified shoe repairmen after 2 years of on-the-job training.

Some repairmen learn how to repair shoes in vocational schools that offer such training. Others receive

their training under the provisions of the Manpower Development and Training Act; still others enter the occupation through apprenticeship training programs.

Skilled shoe repairmen who work in large shops can become foremen or managers. Those who have the necessary funds can open their own shops with an investment of \$500 to \$1,000.

### Employment Outlook

Employment of shoe repairmen is expected to show little or no change during the remainder of the 1960's and throughout the 1970's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work. Retirements and deaths alone are expected to provide nearly 1,500 job openings annually. In addition, there are many jobs currently unfilled because of a shortage of qualified shoe repairmen. Moreover, the number of repairmen currently being trained is insufficient to fill present or prospective job openings.

Several factors will tend to limit the growth in requirements for shoe repairmen. In recent years, the popularity of canvas footwear, loafers, sandals, and cushion-soled shoes has increased. Because of the construction of these types of shoes, they often cannot be repaired. In addition, many shoes are being made of more durable, long-wearing materials and need repair less frequently. Also, as personal income rises many people buy new shoes rather than repair old ones.

### Earnings and Working Conditions

A nationwide survey of union-management agreements in early 1967 indicated that most shoe repairmen earned between \$90 and \$100 for a 40-hour week. Those who were managers of shoe repair shops earned more than \$150 per week and

trainees generally earned about \$55 per week.

Earnings of self-employed shoe repairmen varied considerably, depending on the size and location of the shop and the owner's managerial ability. Shoe repairmen who operated clean, modern shops often earned more than \$7,500 per year. On the other hand, those who owned shops in small communities sometimes earned less than \$3,000 per year.

Shoe repairmen generally work 8 hours a day, 5 or 6 days a week. The workweek for the self-employed, however, is often longer, sometimes 10 hours a day, 6 days a week. Although shoe repair establishments are busiest during the spring and fall, work is steady with no seasonal layoffs. Employees in large shops receive from 1 to 3 weeks' paid vacation, depending on the length of time employed. Usually, at least 6 paid holidays a year are provided.

Repair shops usually are crowded and noisy; small shops are sometimes poorly lighted and ventilated, and are subject to strong odors from leather goods, dyes, and stains. Working conditions in large repair shops and in shoe repair departments of shoe stores and department stores generally are good.

Shoe repair work is not strenuous, but does require physical stamina since shoe repairmen must stand a good deal of the time.

### Where To Go for More Information

Information on training and other aspects of the trade may be obtained from:

Shoe Service Institute of America,  
222 West Adams St., Chicago, Ill.  
60606.

Information about local work opportunities and manpower development and training programs can be obtained from local offices of the State employment service.

## STATIONARY ENGINEERS

(D.O.T. 950.782)

### Nature of Work

Stationary engineers operate and maintain equipment in industrial plants and other buildings that is essential to power generation, heating, ventilation, humidity control, and air conditioning. These workers are needed wherever large boilers, diesel and steam engines, refrigeration and air-conditioning machines, generators, motors, turbines, pumps, compressors, and similar equipment are used. They must operate and maintain the equipment in accordance with State and local laws since the safety of many people depends upon its proper functioning.

The most important duty of stationary engineers is to make certain that the equipment for which they are responsible is operating properly. They must detect and identify any trouble that develops by analyzing their readings of meters, gages, and other monitoring instruments and by watching and listening to the machinery. They operate levers, throttles, switches, valves, and other devices to regulate and control the

machinery so that it works efficiently. They also record such information as the amount of fuel used, the temperature and pressure of boilers, the number and pieces of equipment in use, and any repairs that are made.

Stationary engineers usually repair the equipment they operate, using handtools of all kinds, including precision tools. Common repairs involve reseating valves, replacing gaskets, pumps, packings, bearings, and belting, and adjusting piston clearance. Occasionally, stationary engineers make mechanical changes so that the equipment will operate more efficiently or conform to the requirements of a different process.

The duties of stationary engineers depend on the size of the establishment in which they work and the type and capacity of the machinery for which they are responsible. However, their primary responsibilities are very much the same for all kinds of plants—safe and efficient operation of their equipment. In a large plant, the chief stationary engineer may have charge of the entire operation of the boilerroom and direct the work of assistant stationary engineers and other employees including turbine operators, boiler operators, and air-conditioning and refrigeration mechanics. Assistant stationary engineers may be responsible for the operation of all the equipment during a shift, or they may be in charge of a specific type of machinery such as air-conditioning equipment. In relatively small establishments, stationary engineers may be responsible for the operation and maintenance of all mechanical and electrical equipment.

### Where Employed

In early 1967, more than 260,000 stationary engineers were employed in a wide variety of establishments, such as power stations, factories, breweries, food-processing plants, steel mills, sewage and water-treatment plants, office and apartment buildings, hotels and hospitals. Federal, State, and local gov-

ernments also employed large numbers of these workers. The size of establishments in which the engineers worked ranged from giant hydroelectric plants and large public buildings to small industrial plants. Most plants which operate on three shifts employ from 4 to 8 stationary engineers, but some have as many as 60. In many establishments, only one engineer works on each shift.

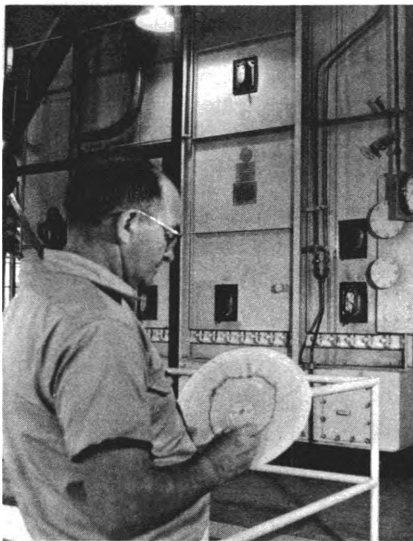
Because stationary engineers work in so many different kinds of establishments and industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial establishments are located. New York, Texas, California, Illinois, Pennsylvania, Ohio, New Jersey, and Michigan employ well over half of these workers.

### Training, Other Qualifications, and Advancement

Many stationary engineers start as helpers or craftsmen in other trades and acquire their skills largely through informal on-the-job experience. However, most training authorities recommend formal apprenticeship as the best way to learn this trade, because of the increasing complexity of the machinery and systems.

In selecting apprentices, most joint labor-management apprenticeship committees prefer high school or trade school graduates between 18 and 25 years of age who have received instruction in such subjects as algebra, geometry, trigonometry, shop mathematics, mechanical drawing, machine-shop practice, physics, and chemistry. Mechanical aptitude, manual dexterity, and good physical condition also are important qualifications.

A stationary engineer apprenticeship customarily lasts 3 to 4 years. Through on-the-job training, the apprentice learns to operate, maintain, and repair stationary equipment, such as blowers, generators, com-



Stationary engineer interprets recordings of boiler's performance.

pressors, 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, electric grinders, lathes, and drill presses. He also learns to use precision-measuring instruments, such as calipers and micrometers. In addition, he may be taught how to move machinery by the use of blocks, chain hoists, or other equipment. This on-the-job training is supplemented by classroom instruction and home study 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 many years of experience as assistants to licensed stationary engineers in such occupations as boiler, refrigeration, or turbine operator. This practical experience usually is supplemented by technical or other school training or home study.

Nine States and more than 50 large and medium-size cities have licensing requirements for stationary engineers. Although requirements for obtaining a license 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 applicants who meet these requirements and pass an examination which may be written, oral, or a combination of both types.

Generally, there are several classes of stationary engineer licenses, which specify the steam pressure or horsepower of the equipment the engineer may operate. The first-class license permits the stationary engineer to operate equipment of all types and

capacities without restriction. The lower class licenses limit the capacity of the equipment the engineer may operate. However, engineers with lower class licenses may operate equipment restricted by their license class, provided they are under the supervision of a higher rated engineer—usually one with a first-class license.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, the engineer advances to such jobs as he obtains higher grade licenses. Advancement, however, is not automatic. For example, an engineer with a first-class license may work for some time as an assistant to another first-class engineer before a vacancy requiring a first-class licensed engineer occurs. In general, the broader his knowledge of the operation, maintenance, and repair of various types of equipment, the better are his chances for advancement. Stationary engineers also may advance to jobs as plant engineers and as building and plant superintendents.

### Employment Outlook

Employment of stationary engineers is expected to grow slowly through the 1970's—by a few thousand each year. In addition, it is estimated that about 6,000 new workers will enter this large occupation each year to replace workers who retire or die. Promotions and transfers to other fields of work also will create job openings.

A rise in employment of stationary engineers is expected mainly because of the continuing increase in the use of large stationary boilers and refrigeration and air-conditioning equipment in factories, powerplants, and other buildings. Job opportunities may arise because of the continued growth of pipeline transportation and saline water conversion. However, improved efficiency from more powerful, automatic, and more centralized equipment and better

utilization of workers may limit the growth in the employment of these workers.

### Earnings and Working Conditions

Average straight-time hourly earnings of stationary engineers in 84 cities and areas ranged from \$2.33 in Greenville, S.C., to \$3.80 in San Bernardino-Riverside-Ontario, Calif., according to a 1965-66 survey. In about 2 out of 3 of the cities surveyed, average hourly earnings ranged from \$2.75 to \$3.50. Stationary engineers in charge of large boilerroom operations may earn considerably more than these hourly averages; some earn more than \$180 a week.

Stationary engineers generally have steady year-round employment. They usually work a straight 8-hour day and 40 to 48 hours a week. In plants or institutions that operate around the clock, they 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 union-employer contracts. Most of these contracts provide fringe benefits, which may include hospitalization, medical and surgical insurance; life insurance; sickness and accident insurance; and retirement pensions. Similar benefits also may be provided in plants which do not have union-employer contracts. Among the unions to which these workers belong are the International Union of Operating Engineers and the International Union, United Automobile, Aerospace and Agricultural Implementation Workers of America.

Most enginerooms, powerplants, or boilerrooms where stationary engineers work are clean and well-lighted. However, 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, electric shock, and injury from moving machinery. If the equipment is defective or is not operated correctly, it may be hazardous to them and to other persons in the vicinity.

### Where To Go for More Information

Information about training or work opportunities in this trade may be obtained from local offices of State employment services, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Information about the occupation also may be obtained from:

International Union of Operating Engineers,  
1125 17th St. NW., Washington,  
D.C. 20036.

National Association of Power Engineers, Inc.,  
176 West Adam St., Chicago, Ill.  
60603.

## STATIONARY FIREMEN (BOILER)

(D.O.T. 951.885)

### Nature of Work

Stationary firemen employed in manufacturing plants are semiskilled workers who operate and maintain steam boilers used to power industrial machinery, and to heat factories. Some experienced stationary firemen may be responsible for inspecting boiler equipment, for lighting boilers, and building up steam pressure. On the other hand, the responsibilities of some stationary firemen may be limited to keeping equipment in good

working order by cleaning, oiling, and greasing moving machinery parts.

In most plants, stationary firemen operate mechanical devices that control the flow of air, gas, oil, or powdered coal into the firebox in order to keep proper steam pressures in the boilers. Duties of these workers may include reading meters and other instruments to make sure that the boilers are operating efficiently and in accordance with safety regulations.

Fully qualified stationary firemen should be able to detect malfunctions without relying entirely on safety devices. In some plants, stationary firemen may be expected to know how to make minor repairs. Stationary firemen are often supervised by stationary engineers. (The stationary engineer is a skilled worker who is responsible for the operation and maintenance of a variety of equipment, including boilers, diesel and steam engines, and refrigeration and air-conditioning equipment. See statement on Stationary Engineers.)

### Where Employed

About 45,000 stationary firemen were employed in a wide variety of manufacturing industries in early 1967. Generally, these workers are

employed in industries which are large users of power generating equipment. Leading industries in the employment of stationary firemen are lumber, food, iron and steel, paper, chemicals, and transportation equipment.

Because stationary firemen work in so many different industries, they are employed in all parts of the country. Although some are employed in small towns and even rural areas, most work in the more heavily populated areas where large manufacturing plants are located. The States of Ohio, New York, Pennsylvania, Illinois, Michigan, New Jersey, and California accounted for about 45 percent of the total number of firemen.

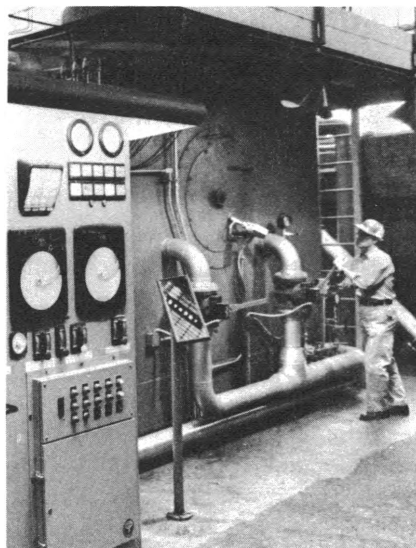
### Training, Other Qualifications, and Advancement

Some large cities, and a few States, require stationary firemen to be licensed. Applicants can obtain the knowledge and experience to pass the license examination by first working as a helper in a boilerroom, or working as a stationary fireman under a conditional license.

License requirements differ from city to city and from State to State. However, the applicant usually must prove that he meets the experience requirements for the license and pass an examination testing his knowledge of the job. For specific information on licensing requirements, consult your State or local licensing authorities.

There are two types of stationary firemen licenses—for low and high pressure boilers. Low pressure firemen operate low pressure boilers generally used for heating. High pressure firemen operate the more powerful high pressure boilers and auxiliary boiler equipment used to power machinery and equipment in addition to heating buildings. Both high and low pressure operators, however, may operate equipment of any pressure class, provided a stationary engineer is on duty.

Stationary firemen should understand the operation of machinery and



Stationary fireman opens valve in gasline to burner.

must have normal vision and good hearing. (Because of the mechanization of equipment, physical strength is no longer a major requirement for this type of work.)

Stationary firemen may advance to jobs as stationary engineers. To become stationary engineers, firemen sometimes supplement their on-the-job training by taking courses in subjects such as practical chemistry; elementary physics; blueprint reading; applied electricity; and theory of refrigeration, air conditioning, ventilation, and heating. Stationary firemen may also advance to jobs as maintenance mechanics.

### Employment Outlook

Employment of stationary firemen in manufacturing industries is expected to decline in the late 1960's and throughout the 1970's. Some opportunities for new workers, however, will result each year from the need to replace workers who transfer to other fields of work or who retire or die.

Although an increase in the use of stationary boilers and auxiliary equipment is expected during the next 10 to 15 years, the trend to automatic, more powerful, and more centralized equipment is expected to result in a decline in employment of stationary firemen. In large plants, however, where turbines and engines are housed under a separate roof and where there is a need for constant surveillance of boilers, firemen will continue to be needed.

### Earnings and Working Conditions

In 1965-66, stationary firemen in manufacturing plants located in 84 metropolitan areas across the country had average straight-time hourly earnings of \$2.77. Average hourly earnings in these areas ranged from about \$1.60 in Little Rock, Ark., to \$3.50 in Detroit, Mich.

Most stationary firemen, even under the most favorable conditions, are at times exposed to noise, high

temperatures, dirt, dust, contact with oil and grease, odors and fumes from oil, gas, coal, or smoke. In repair or maintenance work, these workers may have to crawl inside a boiler and work in a crouching or kneeling position.

Stationary firemen are subject to burns, falls, and injury from moving machinery. Boilers and auxiliary equipment that are not operated correctly, or are defective, may be dangerous to these workers and to other persons in the work vicinity. However, modern equipment and safety procedures have reduced accidents considerably in recent years.

Many stationary firemen are employed in plants that have labor-management contracts, most of which provide benefits that may include paid holidays and vacations, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions. Among the unions to which these workers belong are the International Brotherhood of Firemen and Oilers and the International Union of Operating Engineers.

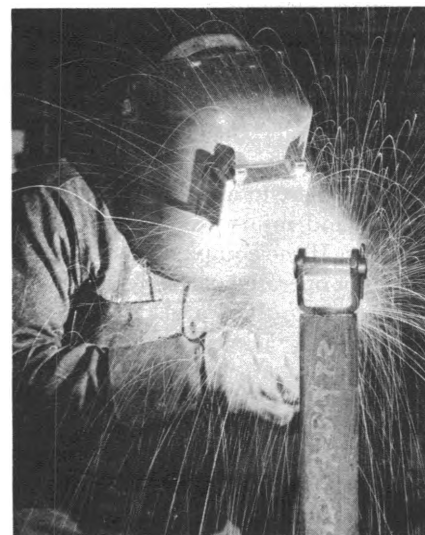
## WELDERS AND OXYGEN AND ARC CUTTERS

(D.O.T. 810. through 819.887)

### Nature of Work

Welding is one of the most common and dependable methods of joining metal parts. Many of the parts used in the manufacture of automobiles, missiles and spacecrafts, airplanes, household appliances, and thousands of other products are joined by this process. Structural metal used in the construction of bridges, buildings, storage tanks, and other structures is often welded. Welding also is used widely to repair broken metal parts.

Closely related to welding is oxygen and arc cutting (often referred to as



flame cutting). Oxygen and arc cutters cut or trim metal objects to a desired size or shape. They also remove excess metal from castings and cut scrap metal into pieces of manageable size.

Welding is a method of joining pieces of metal by applying heat, pressure, or both, with or without filler metal, to produce a permanent bond. Although there are more than 40 different welding processes, most of the processes fall under three basic categories: arc, gas, and resistance welding. Arc and gas welding can be performed manually or by machine. Resistance welding is mainly a machine process.

Most manual welding is done by *arc welders*, *gas welders*, and *combination welders* who do both arc and gas welding. Manual welders may be either skilled or semiskilled. The skilled, all-round manual welder is able to plan and lay out work from drawings, blueprints, or other written specifications. He has a knowledge of the welding properties of steel, stainless steel, cast iron, bronze, aluminum, nickel, and other metals and alloys with which he may be required to work. He is also able to determine the proper sequence of work operations for each job and to weld all types of joints held in various positions (flat, vertical, horizontal, and overhead). The semiskilled manual welder usually performs repetitive

work, that is, production work which, more often than not, does not involve critical safety and strength requirements. The surfaces welded by him are primarily in only one position.

The principal duty of the welder using the manual technique is to control the melting of the metal edges by directing heat to the edges, either from an electric arc or from a gas-welding torch, and to add filler metal where necessary to complete the joint. In one of the most commonly used manual arc welding processes, the welder obtains a suitable electrode and adjusts the electric current. The welder first "strikes" an arc (creates an electric circuit) by touching the metal with the electrode. After the arc is made, the welder guides the electrode at a suitable distance from the edges to be welded. The intense heat caused by the arc melts the edges and the electrode tip. The molten metal from the electrode is deposited in the joint and, with the molten metal edges, solidifies to form a solid connection. During the past two decades, there has been a considerable increase in the use of arc-welding processes that employ inert gas for shielding the weld area. This type of welding was developed for joining hard-to-weld metals such as aluminum, magnesium, stainless steel, and titanium and is now usable with plain carbon steel. Many welders now specialize in this process.

In the late 1950's, the semiautomatic CO<sub>2</sub> gas shielded welding processes were developed. These processes feed a continuous electrode wire into the arc and the gun may be guided by the operator or may be fully automated. The fine wire CO<sub>2</sub> process has almost no spatter or slag and is an all position method. Large wire CO<sub>2</sub> welding has a high deposition rate and is very good for fully automatic applications. The flux cored arc welding procedure has the double advantage of special flux compounds in the center of the wire and also the CO<sub>2</sub> gas shielding. Before considering himself up-to-date, a welder should be able

to use the semiautomatic welding processes.

In gas welding, the welder uses a gas welding torch to apply an intensely hot flame (obtained from the combustion of a mixture of fuel gas—most commonly acetylene and oxygen) to the metal edges. After the welder obtains 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 by directing the flame against the metal until it begins to melt. He then applies the welding rod to the molten metal to supply additional metal for the weld.

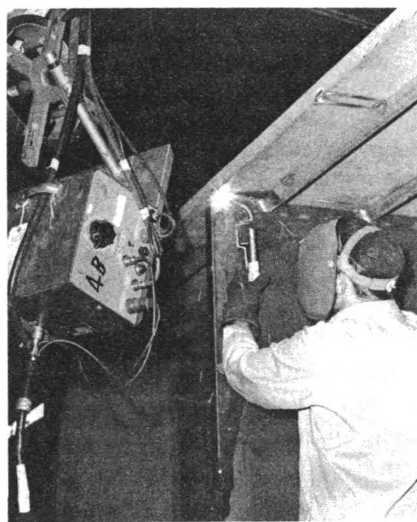
In production processes, especially where the work is repetitive and the items to be welded are relatively uniform, the welding may be done by semiskilled workers who operate welding machines. In resistance welding, the most common type of machine welding, *resistance welding operators* (D.O.T. 813.885) feed and align the work, and remove it after the welding operation is completed. Occasionally, they may adjust the con-

trols of the machine for the desired electric current and pressure.

Workers other than welders frequently use welding in their work. In the construction industry, for example, the structural steel worker, plumber and pipefitter, and sheet-metal worker may at times do manual arc and gas welding. Also, maintenance and repair work provide many welding opportunities for other metal-working and related occupations. (See Index for individual statements on these occupations.)

Semiskilled *oxygen cutters* (D.O.T. 816.782 and .884) and *arc cutters* (D.O.T. 816.884), sometimes called flame or thermal cutters, commonly use hand-guided torches to cut or trim metals. In the oxygen-cutting process, for example, the oxygen cutter directs a flame of fuel gas burning with oxygen on the area to be cut until the metal begins to melt. He then releases an additional stream of oxygen which cuts the metal. The oxygen cutter prepares for the cutting job by attaching the proper torch tip for the particular job, connecting the torch to the gas and oxygen hoses, and regulating the flow of gases into the torch for the desired cutting flame. He then cuts through the metal, manually guiding the torch along previously marked lines or following a pattern. He may mark guidelines on the metal by following blueprints or other instructions. Arc cutting differs from oxygen cutting because an electric arc is used as the source of heat. However, as in oxygen cutting, an additional stream of gas may be released in cutting the metal. An arc with a hollow electrode through which oxygen passes is used in underwater cutting. Other special forms of the arc, such as the plasma arc, are used for cutting ferrous and nonferrous metals.

Oxygen and arc cutters may also operate a torch or torches mounted on an electrically or mechanically controlled machine which by electrical or mechanical control automatically follows the proper guideline.



Welder uses gas-shielded metal-arc process.

### Where Employed

In early 1967, an estimated 460,000 welders and oxygen and arc cutters were employed throughout the country. About 350,000 of these workers were employed in manufacturing industries. Their main employers were firms manufacturing durable goods, such as transportation equipment, fabricated metal products, machinery, primary metals, and electrical machinery. Of the approximately 110,000 welders and cutters employed in other industries, the greatest number were found in construction firms and establishments performing miscellaneous repair services; the remainder were widely scattered among other nonmanufacturing industries.

The widespread use of the welding and cutting processes in industry enables welders and cutters to find jobs in every State. Most of these jobs, however, are found in the major metalworking areas. Slightly more than 50 percent of the jobs were concentrated in seven States—Pennsylvania, California, Ohio, Michigan, Illinois, Texas, and New York. Large numbers of welders and cutters are employed in Detroit, Chicago, Philadelphia, Los Angeles, and other important metalworking centers.

### Training, Other Qualifications, and Advancement

Generally, it takes several years of training to become a skilled manual arc or gas welder, and somewhat longer to become a combination welder (an individual skilled in both arc and gas welding). Some skilled jobs may require a knowledge of blueprint reading, welding symbols, metal properties, and electricity. Some of the less skilled jobs, however, can be learned after a few months of on-the-job training.

Training requirements for the resistance-welding machine 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 most oxygen and arc-cutting jobs; 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 cutting.

Welding and oxygen- and arc-cutting work require manual dexterity, a steady hand, good eye-hand coordination, and good eyesight. For entry in manual welding jobs, most employers prefer to hire young men who have high school or vocational school training in welding methods. Courses in mathematics, physics, mechanical drawing, and blueprint reading are also valuable.

A formal apprenticeship generally is not required for manual welders. However, a few large companies (for example, automobile manufacturers) offer apprenticeship programs that run as long as 8,000 hours for the welding occupations. Also the U.S. Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees.

Programs to train unemployed and underemployed workers for entry level welding jobs and/or to upgrade welding skill requirements have been operating in many cities throughout the United States since 1962, under the provisions of the Manpower Development and Training Act. The training, which may be in the classroom or on-the-job and last from several weeks up to 1 year, stresses the fundamentals of welding. Additional work experience and further on-the-job training may qualify graduates of MDTA projects as skilled welders in a relatively short time.

Young persons entering the welding trade often start in 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 oxygen or arc cutters; they later move into manual welding jobs. Some large companies employ general helpers in mainte-

nance jobs who, if they show promise, may be given opportunities to become welders by serving as helpers to experienced welders and learning the skills of the trade on the job.

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, a municipal agency, a private agency designated by local government inspection authorities, or 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 fields such as atomic energy or missile manufacture, which have high standards for the reliability of welds and require more precise work.

After 2 years' training at a vocational school or technical institute, the skilled welder may qualify as a welding technician. Generally, workers in this small but growing occupation interpret the engineers' plans and instructions. Occasionally, welders may be promoted to jobs as inspectors where they check welds for general conformance with specifications and for quality of workmanship. Welders also may become foremen who supervise the work of other welders. A small number of experienced welders establish their own welding and repair shops.

### Employment Outlook

The number of welding jobs is expected to increase rapidly through the 1970's as a result of the generally favorable longrun outlook for metalworking industries and the wider use of the welding process. In addition,



about 7,000 job openings will occur each year because of vacancies resulting from retirements and deaths. Opportunities will also result as some welders transfer to other lines of work.

Many more manual welders will be needed for maintenance and repair work in the growing metalworking industries. The number of manual welders engaged in production work is expected to increase in plants manufacturing structural-metal products, such as metal doors, boilers, storage tanks, and sheet-metal products. The construction industry will need an increasing number of welders as the use of welded steel structure expands.

Employment prospects for resistance welders are expected to continue to be favorable because of the increased use of the machine resistance-welding process in activities such as the manufacture of motor vehicles, aircraft and missiles, and the production of light, streamlined railroad cars. The use of faster and more highly automatic welding machines, however, will slow down the growth in the number of these welders.

The number of jobs for oxygen and arc cutters is expected to rise somewhat during the years ahead as the result of the general expansion of metalworking activity. The increased use of oxygen- and arc-cutting machines, however, will tend to restrict the growth of this occupation.

### Earnings and Working Conditions

The earnings a welder can expect depend 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. Machine welders, such as resistance welders, who require little training, generally earn less than skilled manual welders.

Average straight-time hourly earnings for skilled manual welders in machinery manufacturing industries in 21 cities and metropolitan areas in mid-1966 ranged from \$2.68 in

Dallas, Tex., to \$3.62 in San Francisco-Oakland, Calif. In about three-fourths of the cities, average hourly earnings for these workers were \$3.10, or more. Average hourly earnings of semiskilled manual welders in 17 of these cities ranged from \$2.17 to \$3.06. Welders who are covered by union contracts may earn considerably more than these average earnings.

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 and Aerospace Workers; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.). Only one labor organization—the International Union, United Weldors (Ind.), is known to be composed entirely of welders, employed largely in the aircraft industry on the west coast.

Labor-management contracts covering welders and oxygen and arc cutters provide employees with benefit programs, which may include paid holidays and vacations, hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions.

Safety precautions and protective devices are extremely important for welders because of the many hazards associated with welding. Welders and cutters use protective clothing, goggles, helmets with protective lenses, and other devices to prevent burns and eye injuries. 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. Operators of resistance-welding machines are largely free from the hazards associated with hand welding. A clear eyeshield or clear goggles generally offer adequate protection to these operators.

### Where To Go for More Information

For further information regarding work opportunities for welders, inquiries should be directed to local employers or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship and other programs that provide training opportunities. General information about welders may be obtained from:

The American Welding Society,  
345 East 47th St., New York, N.Y.  
10017.

International Association of Machinists and Aerospace Workers,  
1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers,  
8th at State Ave., Kansas City, Kans.  
66101.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,  
8000 East Jefferson Ave., Detroit, Mich. 48214.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada,  
901 Massachusetts Ave. NW., Washington, D.C. 20001.

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

### MANUFACTURING

Manufacturing is the activity around which our Nation's economy revolves. From factories flow the goods that have provided a standard of living unmatched elsewhere in the world. The products of the manufacturing industries range in complexity from a simple plastic toy to an intricate electronic computer, and in size from miniature electronic components to gigantic nuclear powered aircraft carriers. Many diverse processes are carried out in manufacturing. Workers refine ores and petroleum, process foods and chemicals, print books and newspapers, spin and weave textiles, fabricate clothing and footwear, and produce the thousands of products needed for our personal and national benefit. Our society, as we know it today, could not have reached its present level of prosperity without the goods provided by the manufacturing industries.

More than 19 million persons worked in manufacturing—the largest of the major industries—in 1966. Within manufacturing, metalworking industries accounted for 45 percent of all workers. The largest employers in the metalworking industries were the

machinery, transportation equipment, and electrical equipment industries, and the primary metals and fabricated metal industries. Each of these industries accounted for at least 1 million workers, ranging from 1.3 million in primary metals to almost 1.2 million in transportation equipment. Producers of nondurable goods account for another two-fifths of total employment in manufacturing. The food processing industries had the largest single work force within this group—1.8 million workers—nearly one-fourth of all nondurable goods employment. Other large employers in the nondurable goods industries are the apparel, printing, chemicals, and textile industries. Tobacco manufacturers are the smallest industry in manufacturing, employing fewer than 100,000 workers altogether.

In 1966, 5.2 million women were employed in manufacturing, accounting for nearly 1 out of every 5 women who worked. Large numbers are employed as secretaries, typists, office machine operators, and in many other office clerical occupations. In some industries, such as apparel, tobacco, electrical equipment, textiles, and instrument industries, women are increasingly being employed in production occupations. They account for a growing proportion of the work force. Thousands of women hold jobs as assemblers, sewers, bindery workers, checkers and sorters, inspectors, and other types of production workers. In heavy industries such as primary metals, transportation equipment, petroleum refining, and lumber and wood products, women workers are employed almost exclusively in white-collar occupations and consequently make up only a small part of the total work force.

As illustrated in the following table, blue-collar jobs made up over two-thirds of the employment in manufacturing in 1966. Operatives and kindred workers alone accounted for 45 percent of the work force. Most of these semiskilled workers were spinners and weavers (textile industry), sewing machine operators (ap-

parel and leather industries), machine tool operators and welders (metalworking industries), furnacemen and heaters (primary metals), or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

Craftsmen, foremen, and kindred workers make up the next largest group of workers, accounting for nearly one-fifth of the employment in manufacturing in 1966. Many of these skilled workers install and maintain the wide assortment of machinery and equipment required in all manufacturing industries. Others are employed in skilled production occupations and are engaged directly in the manufacturing process. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors and typesetters, photoengravers and lithographers, and pressmen make up a large share of the work force. Bakers, millers, stillmen, tinsmiths, millwrights, and tool and diemakers are a few of the other important skilled occupations in manufacturing.

Clerical workers represented the third highest concentration of workers—approximately 1 out of every 8—and in manufacturing were the largest white-collar occupational group.

Professional, technical, and kindred workers accounted for slightly less than 1 out of every 10 workers employed in manufacturing. Engineers, scientists, and technicians represent a large share of the professional workers employed in manufacturing. These highly trained workers are required not only to oversee and guide the production processes, but also to carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries. Other important professional occupations in manufacturing are editor and reporter, accountant, and personnel and labor relations worker.

Major occupation group	Estimated employment, 1966 (percent distribution)
All occupational groups.....	100
Professional, technical, and kindred workers.....	9
Managers, officials, and proprietors.....	6
Clerical and kindred workers..	12
Salesworkers .....	3
Craftsmen, foremen, and kindred workers.....	18
Operatives and kindred work- ers .....	44
Service workers.....	2
Laborers .....	5

NOTE.—Because of rounding, sums of individual items may not add to total.

For the remainder of this decade and through the mid-1970's, population growth, rising personal income, and expanding business activity will stimulate a substantial increase in the

demand for manufactured products. Employment in manufacturing, however, is expected to increase at a slower pace, rising less than 10 percent between 1965 and 1975. The increasing application of modern technology to manufacturing processes, together with the rising skill level of the work force, will make possible substantial increases in production of goods without a corresponding increase in the work force. Although the average rate of employment growth will be slow, employment trends of individual industries within manufacturing will vary widely. Instrument manufacturing employment may increase more than 30 percent, far above the average increase. Industries such as rubber, paper, and electrical machinery and supplies will

more than double the average employment growth rate for all manufacturing. On the other hand, in some manufacturing industries, employment is expected to decline. Petroleum refining, lumber and wood products, tobacco, food, and textiles all may experience some decrease in employment during the 1965-75 decade. Employment in the remaining industry sectors is expected to grow slowly or to remain near their current levels.

The statements that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations that exist in many industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

## Nature and Location of the Industry

Aircraft, missiles, and spacecraft have the same main components: A frame to hold and support the rest of the vehicle, an engine to propel the vehicle, and a guidance and control system. A major difference between them is that missiles and spacecraft can reach into space and attain speeds many times that of sound, whereas aircraft fly in the earth's atmosphere and at slower speeds. Another difference is that aircraft are manned and missiles and most spacecraft are not.

Types of aircraft vary from small personal planes, costing not much more than an automobile, to multi-million-dollar giant bombers and supersonic fighters. Aircraft plants also produce transport planes, helicopters, balloons, and gliders. About two-thirds of aircraft production in dollar value is manufactured for military use; the rest is for commercial passenger and freight traffic, private business and pleasure use, and civilian flying instruction.

Missiles and spacecraft also vary greatly in the purposes for which they are made, and in their size and capabilities. Missiles are produced chiefly for military use and generally carry destructive warheads. Some can travel only a few miles and are intended for such purposes as the support of ground troops and defense against low flying aircraft. Others, such as the Atlas, Titan, and Minuteman, have intercontinental ranges of 7,000 miles or more. Some missiles are designed for launching from land or underground sites; others, for firing from aircraft, submarines, or ships.

Spacecraft are sent aloft carrying instruments which can measure and record conditions in space and transmit the data to receiving stations on earth. Manned spacecraft also include a cabin capsule for astronauts. The first American space vehicles had payloads (useful cargo) weighing only 20 to 30 pounds or less; the Saturn V launch vehicle is able to lift 125-

ton payloads into near-earth orbit, or send almost 50 tons to the vicinity of the moon. Some space vehicles probe the space environment and then fall back to earth. Others are put into orbit and become artificial satellites around the earth, sun, or other celestial body. Nearly all this country's missiles and spacecraft are built for the Air Force, Navy, Army, or the National Aeronautics and Space Administration (NASA).

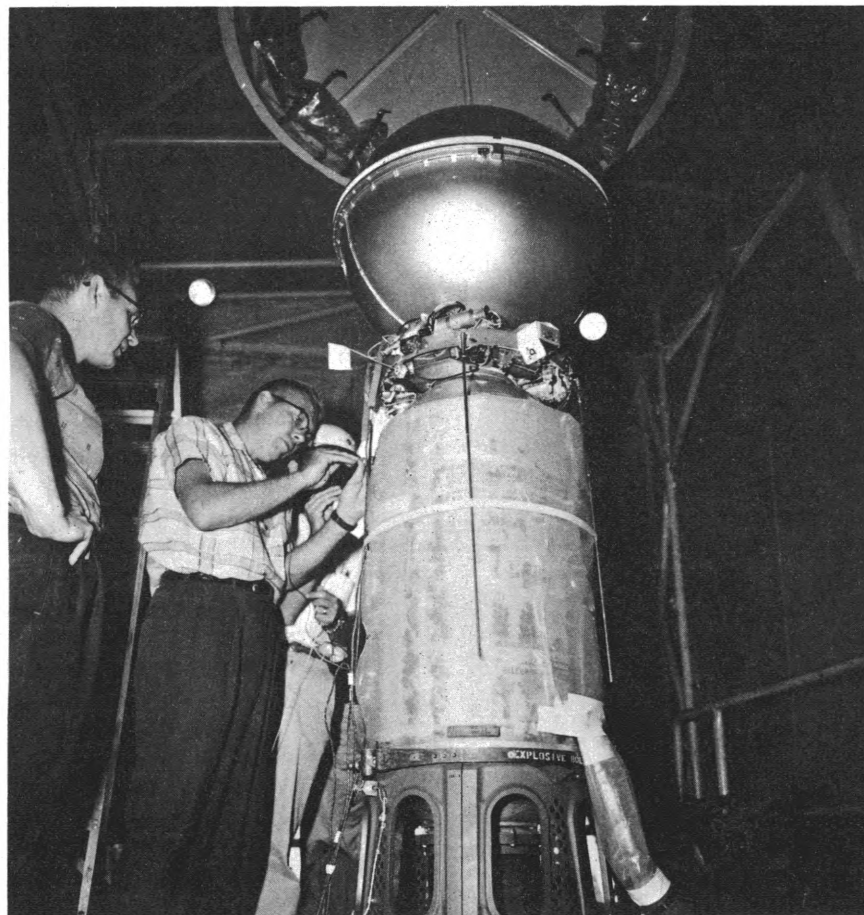
Because the aerospace industry makes many kinds of finished products, it uses many kinds of engines, electronic systems, and other components. Aircraft engines may be reciprocating (piston), jet, or rocket. Missile engines may be jet or rocket. Spacecraft are always rocket powered, because rockets are the most powerful type of engine and can operate in airless space whereas other engine types need oxygen from the air for combustion. Today's rocket engines are powered by chemical propellants, which may be either liquid or solid. New sources of rocket propulsion, such as nuclear or electric energy, are being investigated and may be available in the future. Guidance, control, and instrument payload systems are largely electronic. Because missiles and most spacecraft are unmanned, they generally have more complex guidance and control systems than aircraft.

An aircraft, missile, or spacecraft is manufactured usually under the technical direction of a prime contractor. He manages and coordinates the entire project, subject to periodic inspections by the Federal agency or the airline ordering the vehicle. His engineering department prepares design drawings, blueprints, and other specifications. These go to the production department, where planners work on the many details regarding machines, materials, and operations needed to manufacture the vehicle in the numbers required. Decisions must be made as to what part of the production work will be done by the prime contractor and

## OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

Known generally as the "aerospace" industry, the manufacture of aircraft, missiles, and spacecraft is among the largest and most rapidly changing industries in the country. Some 1.5 million persons were employed in the industry in early 1967, many of whom were engaged in work concerned with such post-World War II developments as jet aircraft, rocket propulsion, supersonic flight, and space exploration. Because of these innovations, intensive effort has been required to develop the new materials and products, and the communications and control concepts necessary for ultrasonic travel in space. Continued efforts to improve and develop aerospace products and technology are expected to ensure the country's defense capability and further advances in space exploration.

Because this industry's products are complex and changing, scientists, engineers, and technicians represent a much larger proportion of total employment than in most other manufacturing industries. These workers probably will account for an even higher proportion of the industry's work force through the 1970's. However, employment of certain skilled, semiskilled, and unskilled workers is expected to decline.



Technicians check space vehicle payload.

what part will be contracted to outside firms.

Special tools, dies, jigs, and fixtures are required in manufacturing the vehicle. Many sheet-metal workers, machinists, machine tool operators, and other metal processors produce these tools and the thousands of parts and components which go into the craft. All parts and equipment must be inspected and tested many times, both before and after they are assembled, and all assembly work must be thoroughly inspected and checked. In every stage of the production process, assemblers and installers are needed to fit together, hook up, and install systems and components. After its final assembly, the vehicle is checked out by a team of mechanics, flight tested if an aircraft, and then prepared for delivery.

Many thousands of subcontractors participate in the production of parts and subassemblies that go into aircraft, missiles, and spacecraft. Some subcontractors make individual parts or supplies, such as metal forgings, bearings, plastic material, rocket fuels, or special lubricants. Others produce subassemblies, such as communications or telemetry equipment, guidance instruments, or jet engines, and may depend on other subcontractors to supply parts for the subassemblies. The prime contractor, too, may manufacture components of a craft, and may do the final assembly work.

Aerospace plants range in size from the large factories of major manufacturers, each with thousands of employees, to the shops of small subcontractors and suppliers with only a few workers each. Jobs in aerospace work

may be found in practically every State, although roughly one-third are concentrated in California. Other States with large numbers of aerospace jobs include New York, Connecticut, Massachusetts, New Jersey, Pennsylvania, Ohio, Florida, Alabama, Maryland, Washington, Texas, Missouri, and Kansas.

An estimated 1.5 million people—about one-fifth of them women—were working on aerospace products in early 1967. About half a million of these workers were producing missiles and spacecraft; almost 675,000 were making aircraft, aircraft engines, and propellers; and more than 225,000 worked in the electronics field producing equipment for aircraft, missiles, and spacecraft. The remainder, approximately 80,000 were mostly civilian employees of the Federal Government working in the aerospace field, primarily in the Department of Defense and NASA. In addition to those employed directly in the aerospace field, thousands of other Federal Government workers were engaged in the negotiation, administration, and supervision of related contracts.

### Occupations in Aircraft, Missile, and Spacecraft Manufacturing

Workers with many different kinds of educational backgrounds and job skills are needed to design and manufacture aircraft, missiles, and spacecraft. For example, engineers and scientists with advanced degrees, as well as plant workers who can learn their jobs after a few days or weeks of training, are employed.

Occupational needs vary among establishments in the industry, depending on the work being done. Research and development laboratories employ mainly engineers, scientists, and supporting technicians and craftsmen. Manufacturers, universities, independent research organizations, and Government agencies such as the Air Force, Navy, Army, and NASA run these laboratories. Factories engaged in production, on the

other hand, employ mostly plant workers such as assemblers, inspectors, tool and die makers, sheet-metal workers, machinists, and machine tool operators.

Some of the more important jobs found in aerospace-products manufacturing are described below, under three major categories: Professional and technical occupations; administrative, clerical, and related occupations; and plant occupations. (Many of the jobs in this industry are found in other industries as well and are discussed in greater detail elsewhere in the *Handbook* in the sections covering individual occupations.)

*Professional and Technical Occupations.* Before production of an aircraft, missile, or spacecraft can begin, a design must be approved. This requires many experiments and "feasibility" studies to determine how well various design possibilities meet the conditions under which the vehicle will be operated. A scale model is made from the approved design. It is tested in wind, temperature, and shock tunnels, on ballistic ranges, and in centrifuges where actual flight conditions are simulated. The next step is to develop a full-size experimental model or prototype, which is thoroughly tested in the air and on the ground. If test results are satisfactory, production may begin. Many modifications in the craft normally are made during the course of design and development, and often even after production has started.

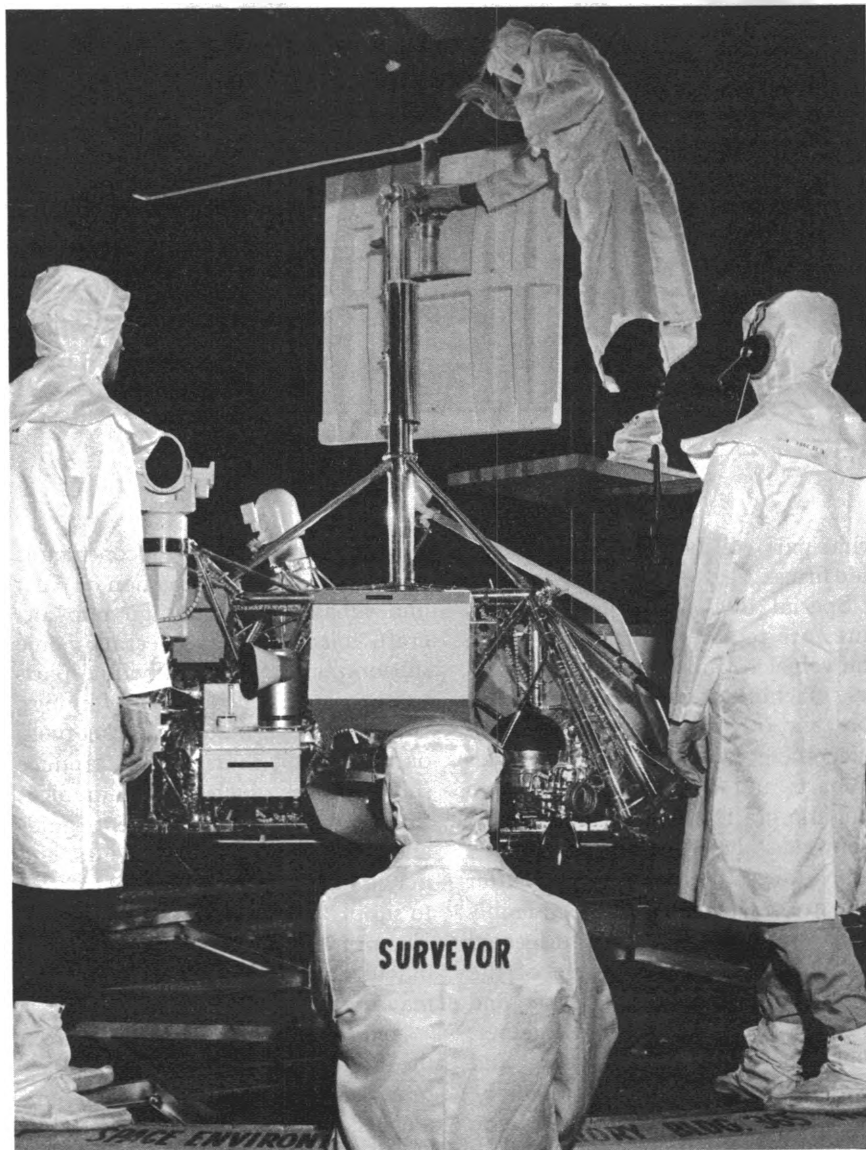
The pace of discovery and change is so rapid that much equipment becomes obsolete while still in the experimental stage or soon after being put into operation. Research and development are vital in the industry, particularly in the missiles and spacecraft field. An intensive effort is being made to develop aerospace vehicles with greater speeds, ranges, and reliability; engines with more power; and metals and plastics with wider capabilities. The industry's research and development capability has encour-

aged aerospace firms to apply their abilities to other new areas of exploration such as oceanographic research, and hydrofoil ocean vessels.

Increasing emphasis on research and development makes the aerospace industry an important and growing source of jobs for engineers, scientists, and technicians. It is estimated that in early 1967 about one-fourth of all employees in plants making aerospace products were engineers, scientists, and technicians, a considerably higher proportion of such personnel than in most other manufacturing industries.

Many kinds of engineers and scientists are employed in aerospace work. For example, over 30 different college degree fields are represented among the engineers and scientists employed by NASA.

Among the more important types of engineers working in the industry are electronics, electrical, aerospace, chemical, nuclear, mechanical, and industrial engineers. Some of the types of scientists employed in the industry include physicist, mathematician, chemist, metallurgist, psychologist, physiologist, and astronomer. Aero-



Workers prepare spacecraft for vacuum chamber test.

space engineers and scientists work in a wide and varied range of applied fields, such as materials and structures, energy and power systems, fluid and flight mechanics, measurement and control systems, communications and data systems, life sciences and systems, and space sciences.

Engineers and scientists are assisted by many types of workers, such as draftsmen, mathematics aids, laboratory technicians, electronics technicians, research mechanics, and research electricians. They work also with *production planners* (D.O.T. 012.188), who plan the layout of machinery, movement of materials, and sequence of operations so that manufacturing processes will flow efficiently from one step to the next; and they work with *technical writers* (D.O.T. 139.288) and *technical illustrators* (D.O.T. 017.281), who produce technical manuals and other literature used to describe the operation and maintenance of air and spacecraft and their many parts.

*Administrative, Clerical, and Related Occupations.* Managerial and administrative jobs are generally comparable with similar jobs in other industries, except that they are related most closely to engineering because of the importance of research and development in the aerospace field. Personnel in these jobs include executives, responsible for the direction and supervision of research and production, and officials in departments such as sales, purchasing, accounting, public relations, advertising, and industrial relations. Many thousands of clerks, secretaries, stenographers, typists, tabulating machine operators, and other office personnel are employed also.

*Plant Occupations.* About half of all workers in the aircraft, missile, and spacecraft field were employed in plant jobs in early 1967. Plant jobs can be classified in the following

groups: Sheet-metal work; machining and tool fabrication; other metal processing; assembly and installation; inspecting and testing; flight check-out; and materials handling, maintenance, and custodial.

*Sheet-Metal Occupations.* Sheet-metal workers shape parts from sheet metal by hand or machine methods. When hand methods are used, the workers shape the part by pounding them with mallets and by bending, cutting, and punching them 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. 804.281) lays out the sequence of operations on the basis of blueprints and other engineering information. He then fabricates complicated metal shapes, using handtools or machines. Less complex parts, as well as those 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 *power brake operator* (D.O.T. 617.380), *power hammer operator* (D.O.T. 617.782), *power shear operator* (D.O.T. 615.782 and 615.885), *punch press operator* (D.O.T. 615.782), and *profile cutting machine operator* (D.O.T. 816.782).

*Machining and tool fabrication occupations.* Another important group of workers engaged in shaping and finishing metal parts with machine tools are *machinists* (D.O.T. 600.280 and .281) and *machine tool operators* (D.O.T. 609.885). The most skilled of these 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 varied and nonrepetitive nature. They are employed most frequently in departments 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, such as a lathe, drill press, or milling machine. The more skilled machine tool operators are able to set up the work on a machine and handle difficult and varied jobs. The less skilled operators usually do more repetitive work.

Machinists and machine tool operators represent a higher proportion of the work force in engine and propeller plants, which are basically metalworking establishments, than in plants performing the final assembly of air and space vehicles. Among engine plants, those manufacturing reciprocating engines do relatively more machining and less sheet-metal work than those producing jet or rocket engines.

Many of the plants in the aerospace industry make a large proportion of the jigs, fixtures, tools, and dies they use. Fabrication of these items requires skilled metal-processing workers, chiefly *jig and fixture builders* (D.O.T. 761.381) and *tool and die makers* (D.O.T. 601.280). Jig and fixture builders make the workholding and tool-guiding devices used in production and assembly operations. On the basis of information received from the engineering department, they plan the sequence of metal machining operations involved in making a jig 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 experts in the use of machine tools.

*Other metal-processing occupations.* Other metalworkers, such as tube benders, riveters, and welders are also employed. *Tube benders* (D.O.T. 709.884) form tubings used for oil, fuel, hydraulic, and electrical conduit lines. *Riveters* (D.O.T. 800.884) and *welders* (D.O.T. 810.782 and

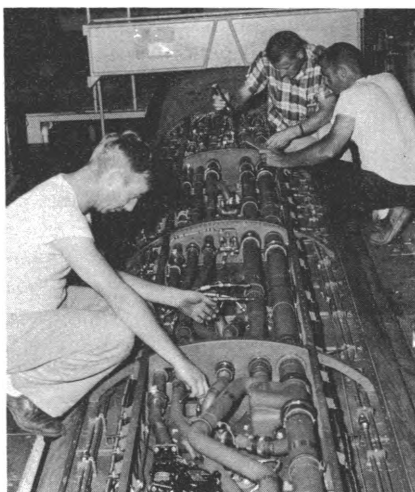
.884; 811.782 and .884; 812.884 and 813.380 and .885) join fabricated parts by hand or machine riveting and by electric arc, gas, or electric resistance welding.

Additional metal fabricating is performed by skilled foundry workers such as patternmakers, molders, and coremakers. Drop hammer operators and other forge shop workers are employed in the forging departments.

Many 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 titles as *heat treater* (D.O.T. 504.782), *painter* (D.O.T. 845.781), and *plater* (D.O.T. 500.380).

**Assembly and installation occupations.** Assembly and installation workers are a major occupational group, employed in practically all plants in the industry. Many work in factories producing engines, electronic equipment, and auxiliary components, but the majority are found in plants that assemble air or space craft into completed form. They perform such final assembly work as the fitting together of major subassemblies and the installing of major components. In aircraft, for example, this work involves joining wings and tail to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. In the course of their duties, assemblers perform such operations as riveting, drilling, filing, bolting, soldering, cementing, and gluing.

A large proportion of assemblers are semiskilled workers doing repetitive work, but some are skilled mechanics and installers. Many of the



**Production mechanics install and inspect fuel and hydraulic lines in aircraft fuselage.**

latter perform diversified assembly or installation operations, and often work on experimental, prototype, or special craft. They assemble, take apart, inspect, and install complex mechanical and electronic assemblies. They read blueprints and interpret other engineering specifications. They may be called *final assemblers* of complete aircraft (D.O.T. 806.781), *missile assembly mechanics* or *rocket assembly mechanics* (D.O.T. 625.281).

Some skilled assemblers are employed in plants which produce relatively large numbers of aircraft and missiles rather than a few experimental types. These assemblers usually specialize in one field of work or more. They are often assisted by less skilled assemblers who do the more routine work. For example, a *class A armament assembler* (D.O.T. 801.381) 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. *Power plant installers* (D.O.T. 621.381), sometimes known as engine mechanics, install, aline, and check the various types of en-

gines and accessories. Skilled *electrical assemblers* (D.O.T. 728.884), sometimes called electricians, install, hook up, and check 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. Assemblers also specialize in other systems, such as plumbing, hydraulic, heating and ventilating, and rigging and controls.

**Inspecting and testing occupations.** Because aircraft, missiles, and spacecraft are extremely complex, thousands of painstaking inspections and tests must be made as each component and part moves toward final assembly of the whole system. Inspections are made not only by employees of the manufacturers but also by civilian employees of Federal agencies which have contracted for the equipment.

Some inspectors specialize in examining materials and equipment purchased from the outside; others inspect components during fabrication and subassembly within their own plants; still others inspect completed craft after their final assembly. Many inspection jobs require highly skilled workers. On the other hand, some tests are made by automatic equipment which can be run by relatively unskilled persons. Such equipment not only checks the component or assembly under test but may run simultaneous checks on itself.

Some of the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.381). They examine machined 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 supplying companies. Other inspectors, frequently known as *receiving inspectors* (D.O.T. 806.384), with less responsibility than outside pro-



duction inspectors, check purchased materials and parts for conformity with blueprints, armed services requirements, and other established standards. They operate testing equipment and must be familiar with specifications of the parts and materials purchased from different sellers.

In the production department, *machined parts inspectors* (D.O.T. 609.381) determine, by the use of precision testing instruments, whether or not a part has been machined properly to conform to blueprint specifications. They may also test for hardness and porosity and determine the "machineability" of castings and forgings. *Fabrication inspectors* (D.O.T. 807.381) are generally skilled sheet-metal workers. They inspect fabricated sheet-metal work and complex parts which have required numerous fabricating operations.

As the parts are fitted together they undergo numerous inspections by *assembly inspectors* (D.O.T. 806.381). These 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. Less skilled assembly inspectors usually check subassemblies. Final testing must be especially rigorous with missiles and most spacecraft since, unlike aircraft, they have no human guidance aboard to correct for improper working of components which may cause a target miss or other failure of the mission.

*Flight checkout occupations.* Checking out an air or spacecraft before its first flight requires a team of mechanics with different levels and types of skills. Sometimes the checking-out process involves making repairs or returning the craft to the plant for repairs. The *chief mechanic*

or *crew chief*, who is the most skilled worker of the team, is responsible for the entire checking-out operation including repair work. He usually directs the work of a crew of mechanics, each of whom specializes in one field or more. For example, *engine mechanics* specialize in checking out the powerplant, including the engine, propellers, and oil and fuel systems. They use handtools, testing equipment, and precision measuring instruments. The *electronics checkout men* perform or supervise the final operational check-out of such systems as radio, radar, automatic pilot, fire control, and complete electronic guidance systems. Other skilled workers may specialize

in checking out and repairing armament, instruments, rigging and controls, plumbing, and hydraulic systems. In some cases, less skilled mechanics help conduct tests and make repairs.

*Materials handling, maintenance, and custodial occupations.* Aerospace plants employ large numbers of materials handlers, such as truckdrivers, crane operators, shipping clerks, stock clerks, and tool crib attendants. Maintenance workers, who keep equipment and buildings in good operating condition and make changes in the layout of the plant, include maintenance mechanics, mill-



Technician adjusts spacesuit air controls.

wrights, electricians, carpenters, plumbers, painters, and welders. Guards, firemen, and janitors make up a major portion of the plant's protective and custodial employees.

### **Training, Other Qualifications, and Advancement**

A college degree in engineering or in one of the sciences is usually the minimum requirement for engineering and scientific jobs in the aerospace industry. A few workers may get jobs as professional engineers without a college degree, but only after years of semiprofessional work experience and some college-level training. Since many kinds of engineers and scientists are employed in aerospace work, college graduates in many different degree fields may qualify for professional jobs in the industry. Regardless of his degree field, the undergraduate student preparing for professional aerospace work is well advised to get as solid a grounding as possible in fundamental concepts and basic general areas of engineering and science. Mathematics and physics courses are especially important, since these sciences provide the necessary language understood by the variety of engineers and scientists working on any given project. Education or training in the more specialized fields of the aerospace industry is generally received in graduate school or on the job.

An increasing number of semiprofessional workers, such as electronics technicians, engineering aids, draftsmen, production planners, and tool designers receive training for their jobs through 2 years of formal education in a technical institute or junior college. Others qualify through several years of diversified shop experience.

Training requirements for plant jobs vary from a few days of on-the-job instruction to several years of formal apprenticeship. Apprenticeship programs develop craftsmen, such as

machinists, tool and die makers, sheet-metal workers, patternmakers, aircraft mechanics, and electricians. These programs vary in length from 3 to 5 years depending on the trade; during this time, the apprentice handles work of progressively increasing difficulty. Besides on-the-job experience, he receives classroom instruction in subjects related to his craft. Such instruction for a machinist apprentice, for example, would include courses in blueprint reading, mechanical drawing, shop mathematics, trade theory, physics, safe working practices, and other subjects.

Many levels of skill are required for other factory jobs. Workers who have little or no previous training or experience are hired for the less skilled assembly jobs. On the other hand, skilled assemblers may need 2 to 4 years of plant experience in addition to a high school or vocational school education or its equivalent. Skilled assemblers must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations.

Skilled inspectors often have several years of machine shop experience. They must be able to install and use various kinds of testing equipment and instruments, read blueprints and other engineering specifications, and use shop mathematics. New workers with little or no experience in shop trades may also be hired and trained for jobs requiring less skilled inspectors.

Mechanics who perform the final checkout of air and spacecraft qualify for their jobs in several ways. Many gain experience as mechanics by working in earlier stages of the plant's production line, before final checkout of the craft. Others receive all their training in checkout work, or come from "line maintenance" jobs with commercial airlines.

Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a

checkout mechanic. Specialized mechanics, working under the supervision of the chief mechanic, usually are required to have at least 2 years' experience. Workers with less experience serve as helpers or assistants and pick up the mechanic's skills on the job and through plant training courses.

Because the manufacture of their complex and rapidly changing products requires workers who are highly trained and aware of new developments, the majority of aerospace plants support some kind of formal worker training. Instruction of this type supplements day-to-day job experience and helps workers advance more rapidly to higher skills and better paid work. Many of the industry's major producers conduct educational and training classes themselves, others pay tuition and related costs for outside courses taken by their employees, and some do both. Some classes are held during working hours, in which case trainees are paid for class time, and other classes are after working hours. Courses are available for practically every occupational group, and cover many skills and areas of knowledge. Examples of subjects typically offered include blueprint reading, drafting, welding, aircraft maintenance and repair, electronic data processing, shop mathematics, supervisory practices, and safe working practices. Most trainees take short-term courses designed to meet immediate skill needs. Only a relatively few employees are enrolled in long-term programs scheduled to run for several years, such as apprenticeship.

### **Employment Outlook**

Aerospace industry employment rose sharply in 1966 reflecting, in part, increased requirements associated with the Vietnam buildup. By the late 1970's, employment in this industry is expected to approximate current (early 1967) levels or decline slightly. However, there still will be

tens of thousands of job opportunities annually in this large field, stemming primarily from the need to replace workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in an estimated 20,000 to 30,000 job openings each year during the next decade.

Products of the aerospace industry have been developed primarily to assure our national security and to advance our goals in the conquest of space. The industry's future, therefore, depends largely on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. In the past, many workers, including some scientists, engineers and technicians, have been laid off during production cutbacks. The outlook in this industry is based on the assumption that defense expenditures (in constant dollars) in the late 1970's will approximate the level prior to the Vietnam buildup. If they should differ substantially, the demand for workers in the aerospace industry will be affected accordingly.

Changes in the relative importance of various segments of aerospace activity may be expected during the next decade. In aircraft manufacturing, employment rose sharply in 1966, reflecting the continually increasing demand for civil aircraft superimposed upon the critical demands of the Vietnam conflict. Employment levels in aircraft manufacturing by the late 1970's may be slightly below the pre-Vietnam level. Jobs in the spacecraft field will probably increase moderately because of space exploration. Continued employment growth is anticipated in plants that produce electronic units for this industry because of the increasing importance of electronic systems and components in aerospace products.

Expenditures for research and development should continue at the current high level or rise slightly.

Employment opportunities will be relatively more favorable for workers such as engineers, scientists, draftsmen, electronics technicians, mathematics aids, and research craftsmen. Many job openings in these occupations will become available not only in manufacturing but also in university laboratories and independent research organizations working on aerospace contracts and in Federal agencies such as the Air Force, Navy, Army, and NASA.

Some job openings will become available also for skilled plant personnel such as machine repairmen. Because of the continuing emphasis on custom production of many diversified products, employment of semiskilled and unskilled assembly line workers is expected to decrease.

### Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1966, for example, production workers in plants making aircraft and parts earned on the average \$142.89 a week or \$3.30 an hour; production workers in all manufacturing industries as a whole averaged \$111.92 a week or \$2.71 an hour. Production workers in the Department of Defense and other Federal agencies receive wages equal to prevailing rates paid for comparable jobs by local private employers.

Earnings for professional and technical workers in the aerospace field are higher than those for similar workers in most other industries because of the rapid growth of research and development activity for missiles and spacecraft, which has created an urgent need for well-qualified engineers, scientists, and technicians. (General information on earnings of professional and technical personnel may be found in the sections on individual occupations in the *Handbook*.)

The following tabulation indicates an approximate range of hourly wage rates for selected occupations in early 1967, obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in the various jobs are wide, partly because wages within an occupation vary according to workers' skills and experience, and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Aircraft mechanics-----	\$2.39-\$3.71
Assemblers -----	2.36- 3.31
Electronics technicians----	2.84- 3.83
Heat treaters-----	2.35- 3.55
Inspectors and testers----	2.32- 4.03
Jig and fixture builders----	2.54- 4.03
Laboratory technicians----	2.31- 3.83
Machine tool operators----	2.32- 3.60
Machinists -----	2.39- 3.76
Maintenance craftsmen----	2.32- 3.76
Riveters -----	2.40- 2.87
Tool and die makers-----	2.76- 4.03
Welders -----	2.37- 3.63

Fringe benefits are common in the industry. Workers usually get 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 or 12 years. They generally get 6 to 8 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, and hospital insurance; accident and sickness insurance; and retirement pensions. Fringe benefits in Federal aerospace employment are comparable with those in the rest of the industry.

Most employees work in modern factory buildings which are clean, light, and airy. Some work is done outdoors. Operations such as sheet-metal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants are comparatively safe working places; the injury-frequency rate in 1966 averaged only about one-third of that for manufacturing as a whole.

Most plant workers in the aerospace field are union members. They

are represented by several unions, among them the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Some craftsmen, guards, and truck drivers are members of unions which represent their specific occupational groups.

#### **Where To Go for More Information**

National Aeronautics and Space Administration,  
Washington, D.C. 20546.

Aerospace Industries Association of America, Inc.,  
1725 DeSales St. NW., Washington, D.C. 20036.

International Association of Machinists and Aerospace Workers,  
1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,  
8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical, Radio and Machine Workers,  
1126 16th St. NW., Washington, D.C. 20036.

Electronics Industries Association,  
1721 DeSales St. NW., Washington, D.C. 20036.

## EMPLOYMENT OUTLOOK IN THE ALUMINUM INDUSTRY

About 90,000 workers were employed in the aluminum industry in early 1967. Employment was concentrated mainly in the rolling and extruding sector, although individual primary reduction plants in some cases employed more workers than rolling and extruding plants.

Considered a specialty metal having limited application only a short time ago, aluminum today is mass-produced in quantities second only to iron and steel. It is used in products ranging from appliances and cooking utensils to automobiles and aircraft. Aluminum siding, containers, and electrical cables are among the more recent applications of this versatile metal. During 1966, the industry produced about 6 billion pounds of primary aluminum—an increase of almost four-fifths above the output of only 10 years earlier.

The use of aluminum is growing rapidly because of its natural properties, the industry's strong research and development activities, and its aggressive marketing program. Some of aluminum's qualities are its light weight, good corrosion resistance, high strength to weight ratio (in alloy form), good heat reflectivity, electrical conductivity and ductility. The major aluminum consuming industries are construction and building supplies, transportation equipment

(autos, trucks, rail, aircraft, ships), electrical and communications, consumer durables (refrigerators, washing machines, and others), packaging, and machinery and equipment.

This chapter describes occupations in the primary aluminum industry which is made up of plants engaged in producing aluminum and aluminum alloys from aluminum oxide (alumina). It also describes occupations in plants engaged in rolling, drawing, and extruding aluminum and aluminum-base alloys. The so-called secondary aluminum industry, which produces aluminum primarily from aluminum scrap is excluded as are the mining of bauxite, fluorspar, and other raw materials and the refining of bauxite to alumina. Occupations concerned with casting, stamping, forging, machining, and fabrication of aluminum are discussed separately in the *Handbook* chapters dealing with forging and machining occupations.

Some companies that produce aluminum are integrated completely—that is, they operate bauxite mines; maintain a fleet of ships to transfer the ore to processing plants; refine the ore into alumina; reduce alumina to aluminum; and form aluminum into semifinished and finished products by rolling and other fabricating methods. Other companies fabricate metal that they produce but buy alumina from other sources. The great majority of companies do not produce the basic metal, but purchase aluminum from primary or secondary (scrap) sources and form the metal into semifinished and finished products.

The South Central area of the country, which includes Alabama, Arkansas, Louisiana, Tennessee, and Texas leads in the production of primary aluminum, although the State of Washington is the Nation's largest producer. Plants within its borders represent about one-fifth of national primary aluminum capacity. The North Central area, consisting of Illinois, Indiana, Michigan, and Ohio,

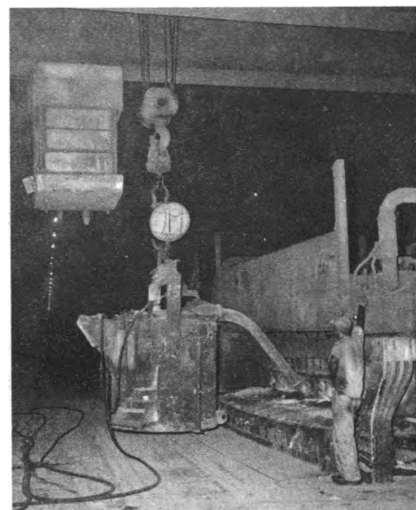
is the center for aluminum rolling, drawing, and extruding plants.

### Occupations in the Industry

Employment in the aluminum industry falls into several categories. First, there is a wide assortment of jobs directly concerned with smelting and transforming aluminum into industrial and consumer products. Another group of occupations maintain and service the complex machinery and equipment used in the manufacturing process. In addition, a fairly large group of clerical, sales, professional, technical, administrative, and supervisory positions is needed to facilitate the production process and to operate the companies.

About 4 out of 5 workers employed in the industry work in production and maintenance occupations. They produce aluminum from alumina and form the metal, maintain plant machinery and equipment, and facilitate the flow of materials throughout the plant. The remaining one-fifth are in clerical, sales, professional, technical, administrative, research, managerial, and supervisory occupations.

Due to the relatively high temperatures associated with aluminum reduction and the strenuous nature of



Aluminum is tapped into crucible.

some tasks necessary for its production, women make up only about 3 percent of the work force in primary aluminum plants. Although most women employed in the industry work in clerical, secretarial, and other office jobs, they constitute 8 to 9 percent of the work force in rolling and drawing plants and are found in such jobs as graders, sorters, and inspectors.

### Processing Occupations

The largest proportion of employees in the aluminum industry are in factory jobs processing the metal. To illustrate the types of processing occupations found in the industry, a description of major steps in the production (reduction) and fabricating of aluminum follows.

To produce aluminum, the metal is separated from the oxygen with which it is combined in alumina by smelting. This process that involves mixing alumina and other additives in a bath of cryolite (sodium aluminum fluoride) takes place in deep rectangular cells or "pots" of thermally insulated steel, lined with carbon. The cells or furnaces are generally about 20 feet long, 10 feet wide, and about 3 feet deep.

**Reduction**—The cells containing molten cryolite are lined with carbon which serve as the cathode or one electrode. Depending on the type of cell used, either one large block of carbon (Soderberg) or a number of small blocks of carbon (prebaked) suspended from the top of the cell acts as the anode or other electrode. Direct electrical current is introduced and the alumina is reduced to aluminum and accumulates at the bottom of the cell. The oxygen is deposited on the anode and is oxidized to carbon dioxide.

**Anode men** (D.O.T. 630.884) are responsible for maintenance of the anodes on the reduction cells. Among their duties are pulling pins from the anodes by means of hydraulic pullers and cleaning scales from the pins us-



Molten aluminum is poured into 1,000-pound ingots.

ing a sandblasting device. They may replace the pins using a steel driver.

**Pot liners** (D.O.T. 519.884) rebuild the Soderberg type anode and reline the reduction furnaces when they burn out. To line the pot, the potliners pour water into it to loosen the sediment. They then dig out the material using jackhammers or diggers. Next they lay a brick base in the pot floor and drop carbon mix into the cell. The potliners line the walls and floor with carbon blocks and tamp carbon paste into cracks using a pneumatic hammer.

**Potmen** (D.O.T. 512.885) tend the reduction pots and are responsible for their continuous operation. Each potman attends a number of different cells. During the operation of the pot, the alumina is gradually consumed. When the dissolved alumina content of one of the cells decreases from approximately 5 percent to 2 percent of the electrolyte, the electrical resistance of the pot rises suddenly from about 5 to 30 volts or more causing an electric bulb on the side of the pot to light up. This development, known as "anode effect" signals the potman to break the crust of the electrolyte

bath and stir in hot alumina which has been lying on the surface. This operation causes the voltage to return to normal levels and the crust reforms. In operating the pots, operators try to reduce anode effects by adding specified amounts of materials at designated time intervals.

Every 24 to 72 hours, part of the molten alumina is syphoned from the bottom of the reduction cells into huge cast-iron crucibles which have airtight lids. The **tapper** (D.O.T. 514.884) and **tapper helper** (D.O.T. 514.887) signal the **hot-metal crane operator** (D.O.T. 921.883) to place the overhead crane near the pot to be tapped. They then break a hole in the electrolytic crust using an automatic pot puncher. One end of a curved cast iron tube is inserted into the pot, the other into a crucible of up to 8,000 pounds capacity. A compressed air hose is attached to the siphon and the molten metal is drawn into the crucible. After the completion of several tappings, an overhead crane removes the loaded crucible to a remelting furnace.

A **scalemen** (D.O.T. 502.887) weighs and takes samples of the molten metal for laboratory analysis and separates grades and types of alloys to be blended with the molten aluminum. The molten metal in the crucibles is poured into a "charging hearth" or remelt furnace. A **remelt operator** (D.O.T. 512.885) adds specified portions of aluminum scrap and molten metal from other crucibles. Other metals are added (alloying) to the furnace to obtain desired properties.

Final steps in the preparation of the metal are fluxing and degassing. A compound is added to flux the molten metal, forcing oxides of aluminum to the surface for a hand skimmer to remove. Before the molten metal is removed from the charging furnace, nitrogen or chlorine gas are added to eliminate the hydrogen gas.

After the alloying and fluxing processes, the metal is transferred to the second compartment of the furnace, the "holding" section, until a sufficient supply is obtained for pouring.

The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station in which the molten metal is cast into ingots. He controls the cooling condition of the casting unit by maintaining a constant level of metal in the molds and operates a series of instruments which spray water against the molds to produce ingots of uniform crystalline structure. *Rolling*—Over half of aluminum wrought products shipped are made up of plate, sheet and strip, which are produced by rolling. The first step in rolling operations is to remove surface impurities from the ingot. The *scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts approximately one-fourth inch layers of metal. To improve corrosion resistance of the surface, ingots are sometimes clad with thin layers of pure aluminum. These layers which are clamped on the sides of the ingot join with the central layer of the sheet during the rolling process. The ingots are brought to proper working temperatures for rolling by heat treating. Overhead cranes lower the ingot vertically into furnaces or “soaking pits” where they are sealed hermetically for 12 to 18 hours. The *soaking pit operator* (D.O.T. 613.782) manages the furnace and sets controls to adjust temperature and heating time.

The huge rolling ingots are positioned on the “breakdown” or hot rolling mill where they are converted into elongated slabs of aluminum. Reduction operations are controlled by trained *rolling mill operators* (D.O.T. 613.782) who manipulate the ingots back and forth between powerful rollers of a large tandem hot reversing mill until it is reduced in thickness to about 3 inches. It then moves down the line on rollers to additional hot mills where the slab is worked down to about one-eighth of an inch thick. At the end of the hot line, a *coiler operator* (D.O.T. 613.885) tends a coiler which automatically winds the metal onto reels.

Coiled aluminum is cooled at room temperature and then cold rolled to a still thinner size. Cold rolling as-

ures a better surface finish and increases the metal's strength and hardness. Since continual cold rolling could make the metal too brittle, intermediate steps of heat treating are necessary. Heat treating or annealing takes place in furnaces under the control of an *annealer* (D.O.T. 504.782). The heating process relieves internal stress in the metal and softens and refines the grain structure. After annealing, the metal is cooled—the whole process generally taking from 12 to 14 hours. However, recent technical improvements have developed annealing methods which require only about one-half the time of the conventional process.

After annealing, the metal may be further cold rolled to a specified thickness and then heat treated again to soften it for future fabrication. To relieve internal stress from rolling and annealing or contour defects, the finished sheet or plate may be placed in large stretchers which pull the metal from end to end. *Stretcher-leveler-operators* (D.O.T. 619.782) and *stretcher-leveler-operator helpers* (D.O.T. 619.886) position the metal in a stationary vise, determine stretch requirements to meet production specifications, and operate the machine

Inspections of the metal to assure quality and consistency of product are made throughout the metalworking processes. Radiographic testing and ultrasonic testing are two processes used for inspection. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to take radiographs of the metal. Computers monitor operations and adjust any differences that may occur between scheduled temperatures, diameter of metals, and speed of operations.

*Fabrication of Rods, Bars, and Structural*s—In rod and bar mills, square castings called “blooms” are heated to make them softer and then rolled through pairs of openings, each progressively smaller, until the proper size is reached. To produce wire, hot rolling is continued until the rod is about three-eighths of an inch in diameter. Then it is cold-worked and

drawn through dies which have openings smaller than the rod to reduce cross-sectional dimensions. *Wire draw operators* (D.O.T. 614.782) operate machines which draw the wire through the series of dies and automatically coil it on revolving reels.

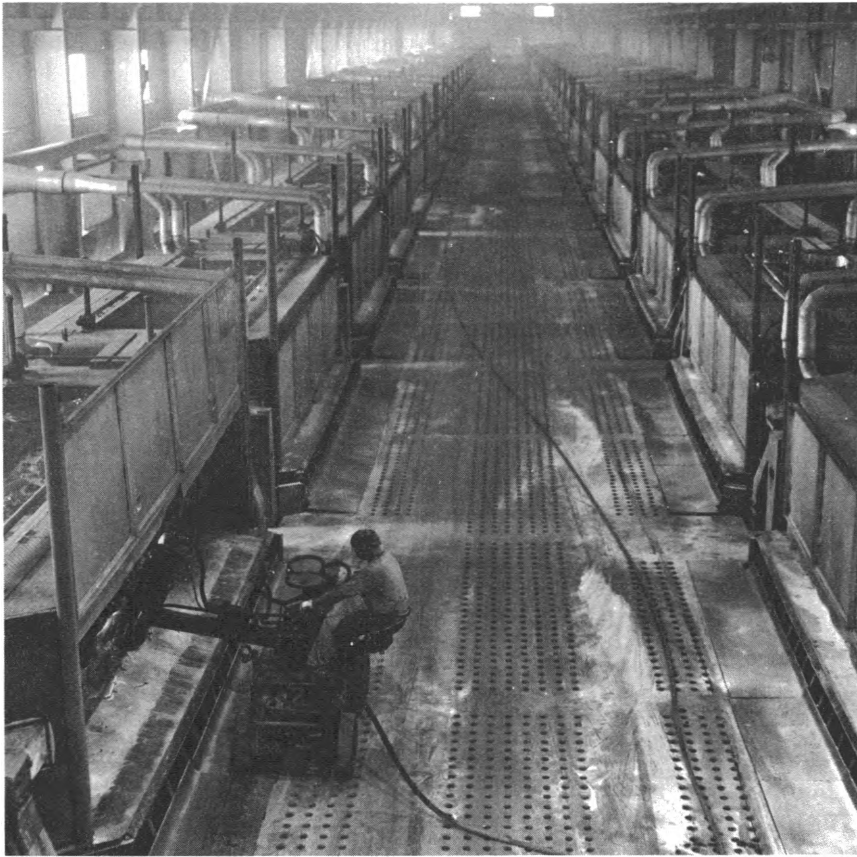
Structural shapes such as **I** beams and angles may be hot rolled or extruded. Hot rolled structurals are made by passing a square bloom with rounded corners between rolls having a series of grooves. As the grooves become smaller, the bloom is reduced in cross section and elongated. The shape of the structural is determined by the contour of the grooves in the rolls.

*Extrusion*. Extruding of metal is often compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing heated billets (aluminum logs) in an enclosed cylinder in a powerful press. A hydraulic ram which has a force of several million pounds pushes the metal through a hole cut in a die at the other end of the cylinder. The metal takes the contour of the die in cross-section and may then be cut into desired lengths. By designing different dies, almost any shape of aluminum product may be formed. The press is operated by an *extrusion press operator* (D.O.T. 614.782) who regulates the rate of extrusion to prevent metal rupture and adherence of metal to contour walls.

Another type of extrusion is impact extrusion, a combination of extrusion and forging. Shapes of aluminum are inserted in dies of powerful presses, some up to three stories high. A punch hits the slug a forceful downward blow and the metal of the slug is forced around the punch. The production process is basically complete in the one blow. Impacts up to 4 and 5 feet are produced in this manner.

### Maintenance, Transportation, and Plant Service Occupations

Large numbers of workers are employed in the aluminum industry to



Tapper breaks hole in electrolytic crust with automatic pot puncher.

keep machines and equipment operating properly. Others are engaged in moving materials, supplies, and finished products throughout the plants; still others are employed in service occupations such as guard, policeman, and custodian. Many of these occupations are also common to other industries. (See index to the *Handbook*.)

The critical importance of electricity to the reduction process requires a relatively large number of *electricians* to install electrical wiring and maintain electrical fixtures, apparatus, and control equipment. *Electronics mechanics* repair computers, industrial controls, radiography equipment, and other complex electronic gear.

*Millwrights* move, maintain, and repair mechanical equipment. They take apart and restore to operating

use machinery essential to aluminum production and fabrication. *Maintenance machinists* are employed in plant machine shops to make and repair mechanical parts used in the plant machinery and equipment. *Stationary engineers* operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

*Diemakers* lay out, assemble, and repair dies used in aluminum metalworking operations. *Bricklayers* build, rebuild, and reline boilers, furnaces, soaking pits, and similar installations. *Plumbers* and *pipefitters* lay out, install, and maintain piping and piping systems for steam, water, and industrial materials used in aluminum manufacture. *Maintenance welders* join metal parts by hand or machine riveting and by resistance welding and electric arc and gas welding.

### Professional, Technical, and Related Occupations

Engineers, scientists, and technicians make up a significant proportion of nonproduction worker employment in the industry.

Quality control is essential in producing aluminum. Companies in the industry employ *chemists* to control the quality by making chemical analyses of aluminum and the raw materials used in its production. *Process metallurgists* study the reduction process to determine the most efficient methods of producing aluminum from raw materials. *Physical metallurgists* conduct microscopic, X-ray, spectroscopic, and mechanical property tests of aluminum and alloys to determine their physical characteristics. They also develop new alloys and new uses for aluminum and alloys.

*Chemical engineers* and *mechanical engineers* design and supervise the construction and operation of reduction and fabricating facilities. Most mechanical engineers are employed in the fabricating sectors of the industry, where they may design, regulate, and improve rolling mills and related equipment.

*Electrical engineers* plan and oversee the installation, operation, and maintenance of the electric generators, transmission, and distribution systems used in the manufacture of aluminum.

*Laboratory technicians* and *chemical analysts* assist engineers and chemists in research and development work. *Draftsmen* prepare the working drawings that are required for the manufacture and repair of reduction and fabricating machinery.

A wide range of other professional and administrative occupations is needed to facilitate the manufacture of aluminum. Top executives manage the companies and determine policy decisions. Middleline managers and superintendents direct individual departments, offices, and operations. Other administrative personnel function in staff positions such as accountants, lawyers, statisti-



cians, economists, and mathematicians.

### Clerical and Related Occupations

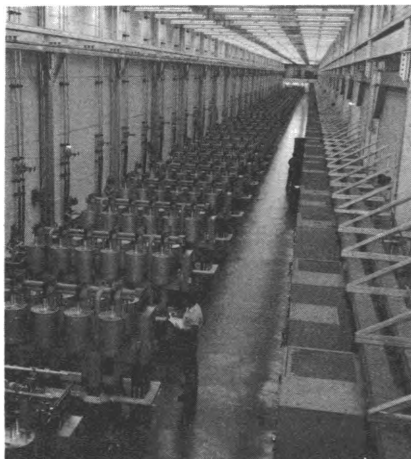
A large group of clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and key-punch and business machine operators, keep records for the company and transact everyday business.

### Training, Other Qualifications, and Advancement

Aluminum companies generally hire and train inexperienced workers for processing and maintenance jobs. For most professional occupations, the minimum requirement is a bachelor's or first professional degree. For research and development work, most companies prefer graduate degrees. Administrative and management positions are filled usually by people who have engineering or other specialized backgrounds and have been promoted to such jobs. Sales positions increasingly are being filled by people having engineering or related technical backgrounds. An advanced technical degree is becoming an important asset for many professional positions and for advancement.

High school graduates who demonstrate a capacity for technical work either through a test or by their job performance are being hired as technicians, laboratory assistants, and other semiprofessionals. A college background in science or graduation from a technical institute or community college is required for many technical jobs.

Some jobs in the industry can be learned in a few days; craft, engineering, and scientific positions require years of preparation. New, unskilled workers often begin their careers in labor pools from which they are assigned to fill in for regular workers who are absent. After working in the pool for a specified period, they become eligible for a permanent



Electrical engineers inspect mercury arc rectifiers.

position in a shop or department. As workers acquire additional skills and seniority with the company they usually move to more responsible and better paying positions. For example, in one company, the promotional sequence was coiler and side trimmer operator to speed operator; speed operator to assistant hot mill operator; and assistant hot mill operator to mill operator. Former production workers fill many foremen and supervisory positions.

Craftsmen are most often trained on the job. A number of companies, particularly the larger ones, have formal apprentice training programs. Under such programs, apprentices take related instruction courses in classrooms or at home and also work with experienced craftsmen to obtain practical on-the-job experience. The length of the apprenticeship varies according to the requirements of the particular craft, although most require 3 or 4 years. The following crafts are included among the apprenticeship programs currently in force in the industry: electrician, welder, brickmason, carpenter, pyrometer man, machinist, maintenance mechanic, pipefitter, diemaker, roll grinder, sheet-metal worker, and automotive mechanic. The method of selecting candidates for apprentice programs varies by company, but generally they are

chosen from promising young men already employed by the company. Applicants must pass aptitude and other tests to demonstrate their potential for work in a particular craft.

### Employment Outlook

During the 1970's, employment in the industry is expected to rise moderately from the approximately 90,000 currently employed even though the amount of aluminum produced annually is likely to increase sharply. Technological developments that contribute to increased output per worker, in turn, will limit the rate of employment growth among some occupations. Most job opportunities will stem from the need to replace workers who retire, die, or leave the industry for other reasons. For example, openings arising from deaths and retirements alone are expected to average about 2,000 a year throughout the 1970's.

Industry expenditures for research and development may continue at recent high levels and this, in turn, may provide favorable employment opportunities for engineers, chemists, metallurgists, physicists, and other technical personnel, as well as for people in areas in which high levels of education and training are needed.

### Earnings and Working Conditions

Earnings of plant workers in the aluminum industry are higher than the average for other manufacturing industries. For example, in early 1967, earnings of production workers in aluminum rolling and drawing plants averaged \$129.74 a week, or \$3.18 an hour. This compares with average earnings of \$112.44 per week, or \$2.79 an hour for production workers in all manufacturing.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Standard hourly rates effective in 1967 for selected occupations in a number of

plants of a large aluminum producer are shown as follows:

<i>Occupation</i>	<i>Hourly wage rate</i>
<b>Reduction:</b>	
Laborer .....	\$2. 64
Scaleman .....	2. 86
Industrial trucker.....	2. 92
Soaking pit operator.....	2. 97
Annealing furnace operator...	3. 03
Potman .....	3. 14
Pourer .....	3. 25
Tapper .....	3. 36
<b>Fabricating:</b>	
Mill helper.....	2. 70
Stretcher-leveler operator....	2. 97
Scalper operator.....	2. 97
Inspector .....	3. 08
Hot mill operator.....	3. 30
Continuous mill operator....	3. 36
4-Hi mill operator.....	3. 41
<b>Maintenance:</b>	
Boiler fireman.....	3. 25
Carpenter .....	3. 52
Welder, pipefitter, millwright .....	3. 58
Layout man.....	3. 69
Electrician, machinist, pyrometer man.....	3. 74

In addition to the above rates, premium pay is given for overtime work and for work on Sundays and holidays. Aluminum workers also receive fringe benefits, such as paid vacations and holidays; retirement benefits; life, sickness and accident, hospital, medical and surgical insur-

ance; shift differentials; and supplemental unemployment benefits.

Salaried personnel generally receive fringe benefits comparable to those for hourly employees in the plant. The salary of employees varies considerably from very high paying executive positions to relatively low paying clerical jobs. The starting salary is determined by a number of factors, some of which are comparable area and industry wage scales, the applicant's qualifications and the structure of the hourly pay scale at the plant. Applicants having technical degrees from accredited colleges can command good starting salaries. Engineering graduates most often receive the highest starting salaries.

The reduction of alumina to aluminum requires high temperatures and makes the potroom a hot place to work. The workplace is often dusty and smoky, though aluminum companies have improved working conditions in recent years in reduction plants through extensive fume control programs and other projects. The fabricating side of the industry offers more favorable work conditions. Workers in certain jobs are subject to high temperatures, noises and other discomforts; however, the plant-wide conditions are more pleasant than

those found in reduction operations. Maintenance shops offer a favorable working atmosphere. Because aluminum reduction is a continuous operation, some workers are required to work at night and on weekends.

The industry stresses safe working conditions and conducts intensive programs of worker safety education. For example, reduction plants have had a consistently lower frequency rate of injuries per man-hour than in other primary nonferrous metal reduction and refining plants.

Most process and maintenance workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office, technical, and security personnel. The unions having the greatest number of members in the industry are United Steelworkers of America (AFL-CIO); Aluminum Workers International Union (AFL-CIO); and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (AFL-CIO).

#### Where To Go for More Information

The Aluminum Association,  
420 Lexington Ave., New York,  
N.Y. 10017.

## OCCUPATIONS IN THE APPAREL INDUSTRY

Over a million workers are employed in making clothing for the Nation's population. The apparel industry produces about \$90 worth of clothing annually for every man, woman, and child.

The industry is an important source of jobs for workers with widely different skills and interests. Many of the jobs in this industry can be learned in a few weeks; others take several years.

Four out of five garment workers are women, making this industry the Nation's largest employer of women in manufacturing. Most women are sewing machine operators. However, many others work in jobs such as hand sewer, bookkeeper, and designer. Men usually predominate in such jobs as cutter and marker, presser, production manager, engineer, and salesman.

### Nature and Location of the Industry

About 1.4 million men and women were employed in the apparel industry in early 1967. About 425,000 made women's garments, such as dresses, skirts, blouses, suits, and coats. Approximately 80,000 made apparel for girls and children. About 120,000 produced tailored clothing (suits, overcoats, topcoats, and sportcoats) for men and boys. More than

360,000 made men's and boys' shirts, slacks, work clothes, separate trousers, nightwear, undergarments and other furnishings. About 30,000 produced hats, caps, and millinery. About 125,000 produced undergarments for women and children. Another 75,000 made fur goods and miscellaneous apparel, such as rain coats, gloves, and dressing gowns. About 170,000 workers classified in the apparel industry produced curtains and draperies.

Apparel factories usually are small. Although there has been a growing trend toward larger establishments in recent years, only a handful employ more than a thousand people each. Most of these large plants make men's and boys' apparel. The great majority of the tens of thousands of apparel establishments located throughout the United States employ fewer than 100 workers each. Plants that manufacture garments that are subject to rapid style changes tend to be smaller than those making standard type garments.

New York City is the Nation's fashion center. Although apparel factories are located in practically every State, most large manufacturers maintain sales offices in New York City. As a result, store buyers flock to its many showrooms to see the latest styles. This is especially true for "high fashion" women's apparel, including dresses, coats, and suits. About one-half of all women's apparel plants and about one-third of all women's apparel workers are located in the New York-Northeastern New Jersey metropolitan area. However, many jobs for workers manufacturing these garments also are found in Wilkes-Barre-Hazleton, Los Angeles-Long Beach, Fall River, New Bedford, Philadelphia, and Kansas City.

In the men's apparel field, the Middle Atlantic region has the largest concentration of factories. The major manufacturing centers of the men's and boys' tailored clothing industry are New York City, Philadelphia, Chicago, Rochester-Buffalo, Allen-

town-Reading-Easton, Baltimore, Boston, Cleveland, Cincinnati, Los Angeles-Long Beach, and St. Louis. Large numbers of apparel workers also are employed in plants located throughout the South and Southwest, frequently in small communities. These plants generally manufacture items such as trousers, work clothing, men's and boys' shirts and nightwear, women's and girls' blouses and skirts, and children's clothing.

### Occupations in the Industry

The major operations in making apparel are designing the garment, cutting the cloth, sewing the pieces together, and pressing the assembled garment. Generally, high-grade clothing and style-oriented garments are more carefully designed and involve more handwork and fewer machine operations than the cheaper, more standardized garments. For example, much hand detailing goes into a woman's high-priced fashionable cocktail dress. In contrast, standardized garments such as men's undershirts, overalls, and work shirts usually are sewn entirely by machine. To make the many different types, styles, and grades of garments, workers with various skills and educational backgrounds are employed in the apparel industry.

*Designing Room Occupations.* Typically, the manufacturing process begins with the *designer* (D.O.T. 142.081) who creates original designs for new types and styles of apparel. The designer usually works with one type of apparel, such as men's suits or women's dresses. Women predominate as the designers of women's dresses; some men design women's coats and suits. For women's apparel, the designer may get ideas by visiting museums, libraries, and major fashion centers in both the United States and Europe. The designer makes sketches of his designs and presents them to the management

and sales staff of his company for approval. The sketches include information about the type of fabric, trim, and color. In designing women's or children's garments, he may make an experimental garment in muslin from approved sketches. He cuts, pins, sews, and adjusts the muslin on a dress form or on a live model until the garment matches his sketch. In large manufacturing plants, a *sample stitcher* (D.O.T. 785.381) prepares these sample garments by following the designer's sketch and performing all necessary machine and hand sewing operations.

The designer of men's wear is a highly skilled production technician. As a result of his extensive knowledge of production operations, he is able to design garments that require a minimum of fabric but have a maximum of style. Styles in men's wear do not change as often as in women's apparel; however, it is still necessary for the men's wear designer to work in close cooperation with the manufacturing plant. For this reason, the designer of men's wear is more likely to work wherever the factory is located. Women's wear designers usually work in New York City.

Since designing is a creative job, designers usually work without close supervision, but they must produce a satisfactory number of successful styles during a season, especially when designing women's fashion garments. A large garment manufacturer generally has one designer and several assistants who often have specialized designing responsibilities of their own. Most small plants and plants making standardized garments do not employ designers but purchase readymade designs or patterns.

When the sample garment or sketch has been approved, it is sent to a *patternmaker* (D.O.T. 781.381) who constructs a full-size master pattern. Working closely with the designer, the patternmaker translates the sketch or sample garment into paper or fiberboard pattern pieces to be used as guides for cutting fabric. In drawing and cutting pattern

pieces, the patternmaker must make allowances for pleats, tucks, yokes, seams, and shrinkage. In some shops designers or all-round tailors make patterns; in other shops the assistant designer performs the patternmaking tasks.

The master pattern serves as a guide for the *pattern grader* (D.O.T. 781.381) who makes a wide range of sizes in each garment style. In a sense, the pattern grader is a specialized draftsman. He measures the pieces that make up the master pattern and modifies them to fit all sizes. The pattern grader then draws an outline of each revised pattern piece on fiberboard and cuts out the pieces by following the outlines. After he completes a set of pattern pieces for each garment size, he attaches a label to identify the part and size of the garment. In some large plants, the length of time required to draw up the pattern for each garment size from the master pattern is being reduced by utilizing a computer.

*Cutting Room Occupations.* Workers in the cutting room prepare cloth for sewing into articles of wearing apparel. There are five basic operations in the cutting department: spreading, marking, cutting, assembling, and ticketing. In small shops, two or more

of these operations may be combined into a single job. Most jobs in the cutting room are held by men.

Spreading may be performed by *hand spreaders* (D.O.T. 781.887) who lay out bolts of cloth by hand, neatly piling the layers into exact lengths on the cutting table. In large plants, *machine spreaders* (D.O.T. 781.884) do this work, using a machine which lays the cloth by traveling back and forth over the table.

In most plants, *markers* (D.O.T. 781.484) trace the fiberboard pattern pieces on large sheets of paper, making several carbon copies of these tracings. In some plants that make men's and boys' suits and coats, the pattern pieces are traced with chalk directly on the cloth itself, rather than on paper. In order to get the greatest number of cuttings from a given quantity of cloth, markers arrange pattern pieces so that there is just enough distance between them for the cutter to work. Figured materials must be marked in such a way that adjoining garment parts will match when the garment is assembled. Larger plants may use miniature patterns in order to study closely the position of patterns; when these patterns are arranged in acceptable positions, a photograph is made that is used for reference in making the full-size paper markers.

The job of a *cutter* (D.O.T. 781-884) is to cut out the various garment pieces from the layers of cloth which are spread on the cutting table. He follows the outline of the pattern on the cloth with an electrically powered cutting knife which cuts through all the layers at once. Sometimes layers of cloth are as high as 9 inches. The work of a cutter and a marker frequently is combined into a single job of cutter-marker.

Other types of cutters are employed in shops making high-quality garments. *Hand cutters* or *shapers* (D.O.T. 781.887) trim and cut the pieces for these garments to make them conform exactly to the original pattern. Sometimes cutters sit in sewing rooms so that they can trim and



Spreader lays out cloth.



Cutter uses round knife machine to cut through many layers of cloth.

shape garments as they advance through sewing operations.

The pieces of cloth that have been cut are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers* or *fitters*, (D.O.T. 781.687) bring together and bundle garment pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They sort the pieces by matching color, size, and fabric design. In addition, assemblers may mark locations for pockets, buttonholes, buttons, and other trimmings with chalk or thread. They identify each bundle with a ticket. The ticket is also used to figure the earnings of workers who are paid on the basis of the number of pieces they produce. The bundles are then routed to the various sections of the sewing room.

*Sewing Room Occupations.* Almost half of all clothing workers are sewers and stitchers. Most of the employees in these jobs are women. Sewers stitch garment cuttings together either by machine or by hand. The quality and style of the finished garment usually determine how much handwork is involved. Generally, higher priced clothing, such as suits

and coats, require more handwork than do standardized garments. In the average plant, however, the work is broken down into a large number of machine operations, with some handwork when the garment nears completion.

*Sewing machine operators* (D.O.T. 787.782) use sewing machines that are generally heavier and capable of faster speeds than the sewing machines found in the home. Special devices or attachments that hold buttons, guide stitches, or fold seams are often used. Some sewing machine operators specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Others make garment sections such as pockets, collars, or sleeves. Still others assemble these completed sections and join them to the main parts of the garment. Some sewing machine operators employed in shops making high priced dresses and women's coats and suits perform all the machine operations on a garment.

Sewing machine operators generally are classified according to the type of machine they use, such as single-needle sewing machine operator or blindstitch machine operator. Others are known by the type of work performed, such as collar stitcher, sleeve finisher, cuff tacker, or coat baster.

Hand sewing is done on better quality or highly styled dresses, suits, or coats to produce garments which are superior in fit and drape. *Hand sewers* (D.O.T. 782.884) use needle and thread to perform various operations ranging from simple sewing to complex stitching. Many hand sewers specialize in a single operation, such as buttonhole making, lapel basting, or lining stitching.

In a typical garment factory, bundles of cut garment pieces move through the sewing department, where the garments take form as they pass through a series of sewing operations. Each operator performs one or two assigned tasks on each piece in the bundle and then passes the bundle to the next operator. Some plants em-

ploy *work distributors* (D.O.T. 787.-782), often called floor boys or floor girls, who move garment pieces from one sewing operation to another.

At various stages of the sewing operations, *inspectors* and *checkers* (D.O.T. 789.687) examine garments for proper workmanship. They mark such defects as skipped stitches or bad seams, which are repaired before passing the garments on to the next sewing operation. Inspectors sometimes make minor repairs. *Thread trimmers* and *cleaners* (D.O.T. 789.-687) remove loose threads, basting stitches, and lint from garments. This is called "in-process inspection."

*Tailoring Occupations.* *Tailors* (D.O.T. 785.381 and .261) and *dressmakers* (D.O.T. 785.361) are able to make a garment from start to finish by hand or by machine. Some skilled tailors who are employed in plants making men's, women's, and children's outer garments may make up sample garments from the designer's specifications.

*Bushelmen* (D.O.T. 785.281), or *alteration tailors*, repair defects in finished garments that were rejected by the inspector. They alter garment parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

*Pressing Occupations.* The shape and appearance of the finished garment depend to a large extent on the amount of pressing that is done during and after sewing operations. Pressing is particularly important in making high-quality garments. For example, from time to time during the sewing of suits, coats, and better quality dresses, seams are pressed open in order to produce a better fitting and neater garment and to make it easier to assemble the garment. This is called "underpressing." In the manufacture of lighter weight garments, on the other hand, pressing is

done only after completion of all the sewing operations.

*Pressers* (D.O.T. 363.782, .884, and .885) use various types of steam pressing machines, including manikins and body forms, or hand irons to flatten seams and to shape garment parts and finished garments. Pressers may specialize in one type of pressing or ironing. For example, in a shirt factory, a *collar pointer* (D.O.T. 583.885) operates a pressing machine that shapes and presses points of shirt collars.

There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations.

*Fur Shop Occupations.* The apparel industry includes plants that manufacture garments made of fur. Because furs are expensive and difficult to work with, each operation in making a fur garment requires skilled handwork by an experienced craftsman. Many of these workers have special skills not found in plants that make other types of apparel.

The most skilled job in a fur garment manufacturing plant is that of a cutter who sometimes is also the foreman in the shop. A *fur cutter* (D.O.T. 783.781) selects and matches enough fur skins to make a single garment, such as a fur coat or jacket. He arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instruction given by the cutter, *fur machine operators* (D.O.T. 787.782) stitch these pelts together to form the major garment sections. A *fur nailer* (D.O.T. 783.884) wets the sewn garment sections, stretches them by hand, and nails them on a board so that they will cover the pattern. When the sections are dry, the nailer removes the



Most sewing machine operators are women.

nails and trims the fur exactly along the outline of the pattern. The fur machine operator then finishes sewing the various sections together to make the complete garment. *Fur finishers* (D.O.T. 783.381) sew in the lining, tape edges, make pockets, and sew on buttons and loops.

*Administrative, Sales and Maintenance Occupations.* The majority of the administrative positions in an apparel plant are in the production department. The production manager occupies a strategic position in apparel firms. He is responsible for estimating production costs, scheduling the flow of work, hiring and training workers, controlling quality, and supervising the overall production activities of the plant.

The industrial engineer advises management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork, required in this industry. In some larger plants, many clerical functions are being done by computers. This requires keypunch operators, computer programmers and operators, and systems analysts. Salesmen, purchasing agents, models, credit managers, and accountants are among other types of workers in the apparel industry. Sewing machine mechanics are responsible for keeping the industry's large number of sewing machines



Pressers use hand irons to shape men's suit jackets.

in good running order. (Discussions of many of these jobs can be found elsewhere in the *Handbook*.)

### Training, Other Qualifications, and Advancement

Training requirements for production (plant) jobs in the apparel industry range from a few days of on-the-job training to several years of training and experience. The difference in training time needed before an employee can reach his maximum speed and efficiency depends on the type of job and the worker's aptitude. Many plant workers pick up their skills while working as helpers or assistants to experienced workers. Apprenticeship is infrequent and is limited mainly to designing, cutting, or tailoring jobs. Some private and public schools in garment manufacturing centers offer instruction in occupations such as designing, patternmaking, and cutting as well as machine and hand sewing.

Physical requirements for most production jobs in the apparel industry are not high, but good eyesight and manual dexterity are essential. Many occupations are well suited for handicapped workers since the majority of the jobs are performed while seated and require little physical exertion. Older workers and women workers also perform well in a variety of

jobs. Many workers in their fifties and sixties are among the industry's most skilled and productive. Women are employed in most of the occupations in this industry, although men hold most of the cutting, tailoring, and pressing jobs.

Designers enter the industry in various ways. Many receive their training by working on the job with experienced designers, by advancing from cutting or patternmaking jobs, or through apprenticeship. There is an increasing tendency for apparel firms to recruit designers from colleges that offer specialized training in design. Some young people with a background in designing may take jobs as designers with small firms, and once their reputations have been established, transfer to jobs in larger, better paying firms. In large firms, young people may start as assistant designers.

A designer should have artistic ability, including a talent for sketching, a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. He should also be acquainted with garmentmaking techniques which he may learn by working briefly at various operative jobs, such as machine sewing, draping, sample making, and cutting.

The production manager usually begins as a management trainee, and the industrial engineer as a junior engineer. A college education is increasingly being required for these jobs. For those without this educational background, many years of on-the-job training in all production processes ranging from selection of fabrics to shipment of finished apparel are often required to qualify as a production manager.

Most patternmakers pick up the skills of the trade by working for several years as helpers to experienced patternmakers. Pattern graders and cutters are occasionally promoted to patternmaking jobs. Patternmakers must have the ability to visualize from a sketch or model furnished by the designer the size, shape, and num-

ber of pattern pieces required. Patternmakers must also have a detailed understanding of how garments are made as well as a knowledge of body proportions. Like the designer, they must also have a thorough knowledge of fabrics.

Pattern graders usually are selected from employees working in the cutting room or in other plant jobs. Training in drafting is helpful since much of the work requires the use of drafting tools and techniques.

Most workers enter the cutting room by taking jobs as assemblers (bundlers or fitters). Patience and the ability to match colors and patterns are necessary qualifications for these jobs. Assemblers (bundlers or fitters), may sometimes be promoted to jobs such as spreader. Several years of experience in the cutting room are required before an employee can become a skilled marker or cutter. A small number of the larger plants have apprenticeship programs which usually last 4 years and include training in spreading, cutting, marking, and patternmaking.

Entry into beginning hand- or machine-sewing jobs is relatively easy for young women, since there are few restrictions regarding educational, and physical condition. Some previous training in sewing operations is preferred, but many apparel plants hire workers who have had no experience in sewing. Generally, training is informal and received on the job. New workers usually start by sewing straight seams, under the supervision of a section foreman or experienced worker.

Most sewing jobs require the ability to do routine work rapidly. The same sewing operation is repeated on each identical garment piece. Since almost all these workers are paid on the basis of the number of pieces produced, any clumsiness of hand may 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 jobs.

The average sewer has little opportunity for position promotion beyond section forelady, although some sewers have worked their way up to the job of production manager. Most sewers stay on the same general type of operation throughout most of their working lives. However, since most sewers are paid according to the number of pieces completed, promotion from beginning sewing jobs to more skilled and better paid sewing jobs in the same field is very common.

Some tailors and dressmakers learn the trade through vocational training in day or evening schools. Graduates from vocational schools frequently are hired and given additional training on the job. Others learn the trade informally, on the job, first doing relatively easy sewing operations and progressively advancing to more difficult operations. It requires several years of experience to become an all-round tailor or dressmaker.

Tailors and dressmakers may qualify for jobs as fitters or alteration tailors in department stores, clothing stores, and cleaning and dyeing shops.

Pressers usually begin as underpressers working on simple seams and garment parts. This job can be learned in a very short time. After the pressers gain experience, they work on more difficult operations and eventually may be promoted to the job of finish presser. Pressing, like tailoring, is one of the few needle trades in which workers can find similar employment in stores and in cleaning and dyeing shops. There is some transferring back and forth between pressing jobs inside and outside the apparel industry.

### Employment Outlook

Total employment in the apparel industry during the remainder of the 1960's and throughout the 1970's is expected to increase moderately above the 1.4 million employed in early 1967. In addition to the thousands of job opportunities expected to result from employment growth, a considerable number of opportunities for

young people will occur because of the tens of thousands of experienced workers who will leave the industry. About three-fourths of the industry's workers are women, a large number of whom leave the industry each year to marry or to raise families. Also, there are more older workers in this industry than in many other industries. It is estimated that deaths and retirements alone will provide 50,000 job openings annually.

Demand for apparel in the years ahead is expected to increase rapidly and will be the major reason for the rise in employment. Employment in the apparel industry is not expected to increase as rapidly as demand, however. Anticipated increases in the size of apparel firms and rising research and development expenditures to improve apparel production operations are expected to result in a gradual increase in the use of mechanized equipment and other labor-saving devices. Examples of such equipment include sewing machines that can position needles and trim threads automatically; devices that automatically position fabric pieces under the needle and remove and stack completed pieces; equipment that automatically spreads fabrics; computers that aid in the detailed planning of pattern placement; and better methods of moving fabrics and apparel through the plant.

The increased demand for apparel will result mainly from a growing, more affluent, and younger population. For example, the number of people in their teens and twenties will rise greatly in the years ahead, and these are the age groups in which spending for apparel is greatest. The trend toward more workers in clerical, sales, professional, and other white-collar occupations will increase the demand for apparel, since these workers spend more for apparel than other workers. Increasing numbers of working women, particularly those in secretarial and other office jobs that require "dressing up," will stimulate apparel purchases. Men, also, are buying more clothing, including highly

styled garments as well as sports and leisure wear.

Most of the opportunities for employment will be in sewing machine operator jobs because this is the largest occupational group, and because this group, made up mostly of women, has a high turnover rate. Some job openings also will occur in tailoring occupations in which a large proportion of the employes are older workers. There will be many opportunities for designers because this group also is composed largely of women.

There also will be several thousand job opportunities, each, for industrial and mechanical engineers, salaried managers, and skilled machine mechanics. Shortages of these workers probably will continue due to the expected growth in the size of individual apparel establishments, in the number and size of companies operating more than one establishment, and in the installation of new mechanical equipment.

Opportunities for jobs as tailors, sample makers, and other skilled occupations in the apparel industry will continue to be mainly in the metropolitan centers where plants manufacturing dresses, women's suits and coats, or men's and boys' suits and coats are located. There will be a small number of new employment opportunities in men's clothing designing, patternmaking, and cutting room jobs.

### Earnings and Working Conditions

In early 1967, average earnings of production workers in the apparel industry were \$68.80 a week or \$1.89 an hour, compared with \$111.92 a week or \$2.71 an hour for those in all manufacturing industries. Production workers in this industry generally worked fewer hours per week than those in manufacturing as a whole. Production workers have much higher earnings in some kinds of garment factories than in others.